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Mapping Integration Definition for Information Modeling (IDEF1X) Model into CASE Data Interchange Format (CDIF) Transfer File

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Section 3: CDIF - Case Data Interchange Format
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      This shows the problem of mapping an IDEF1X categorization relationship into a CDIF transfer file and explains how this problem can be solved.

Appendix B: Helpful Diagrams
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Glossary
      This gives some CDIF definitions of terms used within this document.

References
      This provides the references to the documents used in creating this report.

Conventions:

The conventions defined below are used throughout the Section 4 of this document:

* [Italics] is used for all CDIF meta-entities and meta-relationships (e.g., *ForeignKey*)

* [Bolded Italics] is used for all CDIF meta-attributes (e.g., *SequenceNo*)

* [Underline] is used for values for CDIF meta-attributes (e.g., *EntityType* = <u>Kernel</u>)

1. BACKGROUND

The Integration Definition for Information Modeling (IDEF1X) is a standard modeling technique used in the logical definition of an organization's data resources. The standard defines the syntax and semantics of the language constructs used in creating an information model. With the acceptance of the standard, more vendors are providing support for this technique.

One serious limitation to the standard is the lack of a formal standard mechanism for transferring information between different IDEF tools and between IDEF tools and other tools for different modeling techniques. This leaves the users of IDEF tools at a great disadvantage. A user is restricted to using a particular tool provided by a particular vendor thus seriously hindering the reusability of the information represented in a model. This may also force an organization to mandate the use of a specific tool. This infringes on a users freedom to use a tool that best supports both the work and the users particular style.

One solution is the use of a standard method to exchange data between tools. The CASE Data Interchange Format (CDIF) Family of Standards is primarily designed to be used as a description of a mechanism for transferring information between CASE tools.

Vendors who support the CDIF standards need only define the exchange mechanism once for their particular tool. This would allow the exchange of information developed using a particular vendor's tool with other vendors' tools that support the CDIF standards. Not only would the use of these standards allow users of IDEF tools to exchange data between IDEF tools, it could also support the exchange of information captured by an IDEF tool with other CASE tools.

The ability to freely exchange data between tools benefits an organization by promoting the reuse of information resources. It also allows the IDEF users to focus more on the analysis of business and information problems instead of problems and limitations of tools.

2. INTRODUCTION

This document will describe a mapping of an IDEF1X view into the CDIF transfer file. This work will demonstrate that it is possible to use the standard exchange for moving information between different tools.

CDIF has defined a Meta-model which captures the semantics of data used by numerous tools. The Meta-model has a set of different subject areas allowing the vendors to express the contents of their tool repositories using a standard format. This provides a common definition of model data for communicating between different tools.

CDIF can also be used in situations where vendor defined data that does not map to the Meta-model (extensible data) needs to be transferred. The CDIF Family of Standards includes a Framework for Modeling and Extensibility Standard which allows a vendor to define new meta-objects used to capture this extensible data. It also defines the relationships which link the newly defined meta-objects to the existing standard Meta-model.

3. CDIF - CASE DATA INTERCHANGE FORMAT

3.1 Introduction

CDIF consists of a set of standards referred to as the CDIF Family of Standards which provides a standard means for exchanging information between CASE tools. These standards can move both the syntax and semantics of information captured within a particular tool.

The current set of standards is broken into four sections: Overview, Framework, Integrated Meta-model, and Transfer Format. This report uses information defined in the Integrated Meta-model section.

The Integrated Meta-model is divided into partitions or subject areas. Each subject area defines a meta-model for specific types of information that could be developed using a CASE tool. For example, the Dataflow Subject area defines meta-data for process flow models, the Data Model Subject area defines meta-data captured in data models, and Presentation Location and Connectivity Subject area is used to capture the syntactic data about a particular model.

The components of CDIF that were used for this mapping were Common Subject Area, Data Definition Subject Area, and Data Modeling Subject Area. All three subject areas were necessary for capturing the types of information created by the IDEF1X tools.

The Common Subject Area applies to all of the CDIF Meta-model standards. It is used to capture information relevant to all system development objects. It addresses such items as who created the object, when it was last updated and possible synonyms for the object.

The Data Definition Subject Area is used to define data elements and attribute structures. These elements and structures can be referenced with meta-objects from other subject areas. In the IDEF1X mapping the data content for entities was defined using this subject area.

The Data Modeling Subject Area standard is used to capture information created using an Entity-Relationship-Attribute modeling tool. It uses the concept of a role in a relationship to allow for many variations of relationship modeling. This allows for representation of not only the one-to-many unattributed relationship but also the n-ary attributed one. This subject area also supports key definitions for entities and tables, single and multiple inheritance for entities and relationships, multiple data model views, as well as clusters and subsets.

3.2 Using CDIF to transfer IDEF models.
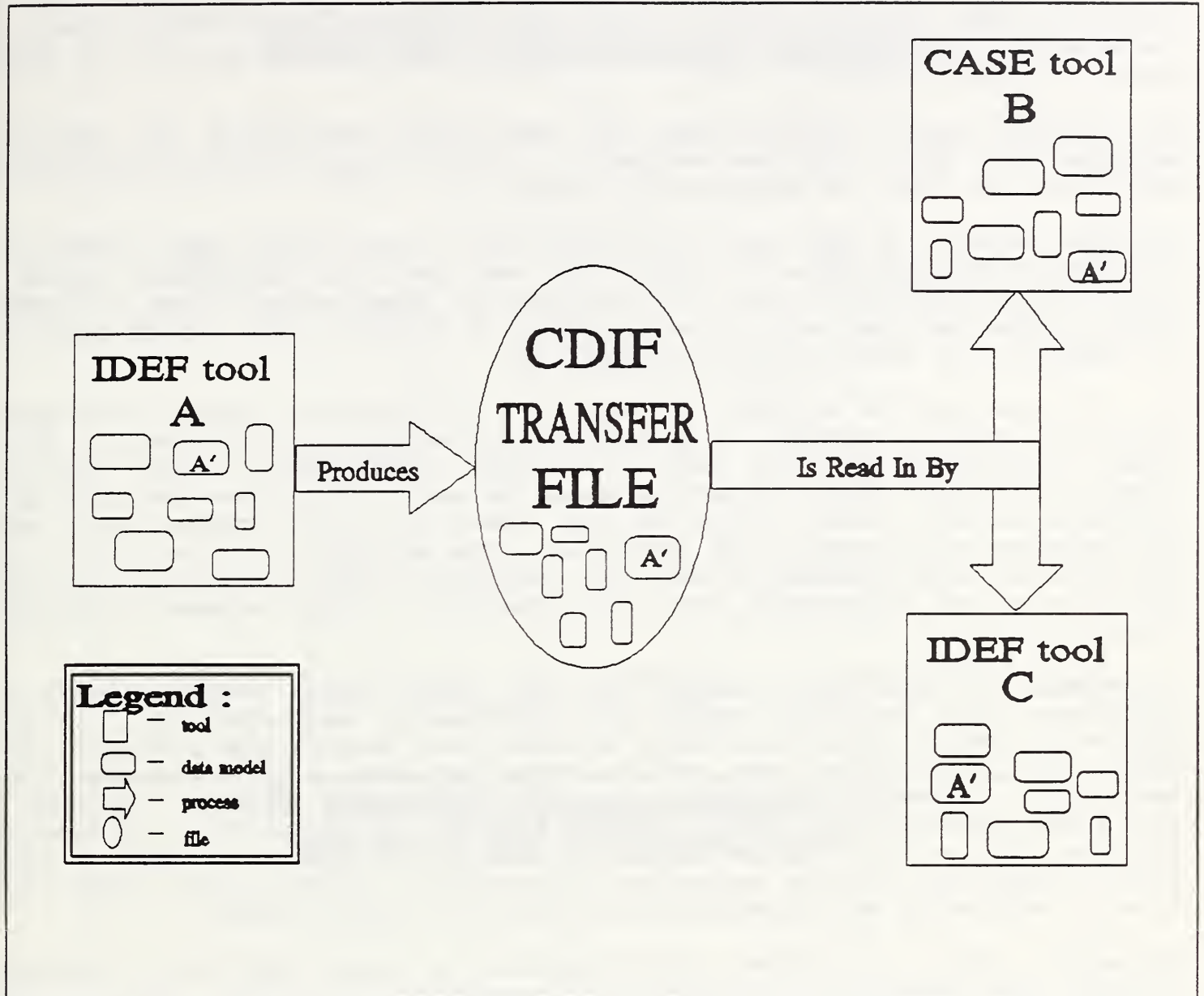
Figure 1

It is very important to understand the basic concepts of a CDIF based transfer. There exists an IDEF tool A with some data models. This tool produces a CDIF transfer file for a particular data model A'. This file can then be read in by another IDEF tool C or a CASE tool B. The CDIF transfer file preserves the concepts of A' through the transfer into the other tools. A' can now be accessed, printed, and modified by a user of tool C or a user of tool B without any influence on the model A' in tool A.

3.3 Benefits

Many benefits can be gained from the use of the standard transfer mechanism. One great benefit to the users of IDEF tools is the ability to reuse already created models. Much time and money is currently spent on developing information models, when a lot of the data components of these models already exist.

To promote reuse organizations are developing procedures for managing standardized data. CDIF can be used to assist in this effort by providing the exchange form for standardized data.

Another benefit to the user is the ability to use tools best suited for a particular job. Models created by one user for a project using a particular tool can be read and modified by other users using different tools. This can also save time and money by reducing the effort spent on purchasing and learning new tools.

If an organization chooses to exchange information between different tools it usually invests in customized converters to get the job done. These converters may not work on updated versions of those specific tools. Also additional converters would be needed for expanding this data exchange between other tools. As the number of tools increases so does the problem of managing the transfers. The benefit to using CDIF as a solution to this problem is that CDIF reduces or even eliminates the need for customized converters for the transfer of data between different tools.

A benefit to IDEF tool vendors is that their tools would be able to interface with multiple tools thus increasing marketability. As the figure in section 3.2 indicates, an IDEF tool stores the contents of a model in a file which then can be converted into a CDIF transfer file using the converter developed by the IDEF tool vendor. Through a converter developed by another vendor the CDIF transfer file can then be changed into a file format which is used by the specific CASE or IDEF tool. Since the transfer mechanism is standard, vendors could spend more time on enhancing and developing features for their tools.

Moreover, there is another great benefit to using CDIF as a transfer format. CDIF transfers the syntax and semantics of a model. This is very important to IDEF users because more than the diagrams are transferred between tools. It would be incorrect to simply map a box from an IDEF (or CASE) tool to a box in some other CASE tool without checking the semantics for a box in both tools because those boxes may have different meanings. For example, in the following two pages an IDEF1X relationship is mapped to an ER relationship using CDIF. CDIF stores the relationship content in its meta-model form. CDIF uses different meta-entities to store the contents of the IDEF1X relationship "contains." A CASE tool would then extract this information and represent it in the graphical form.

3.4 Example: transferring an IDEF1X relationship into E/R relationship

IDEF1X relationship example.

School

Student

contains

Figure 2

ER relationship diagram transferred from the IDEF1X diagram above.
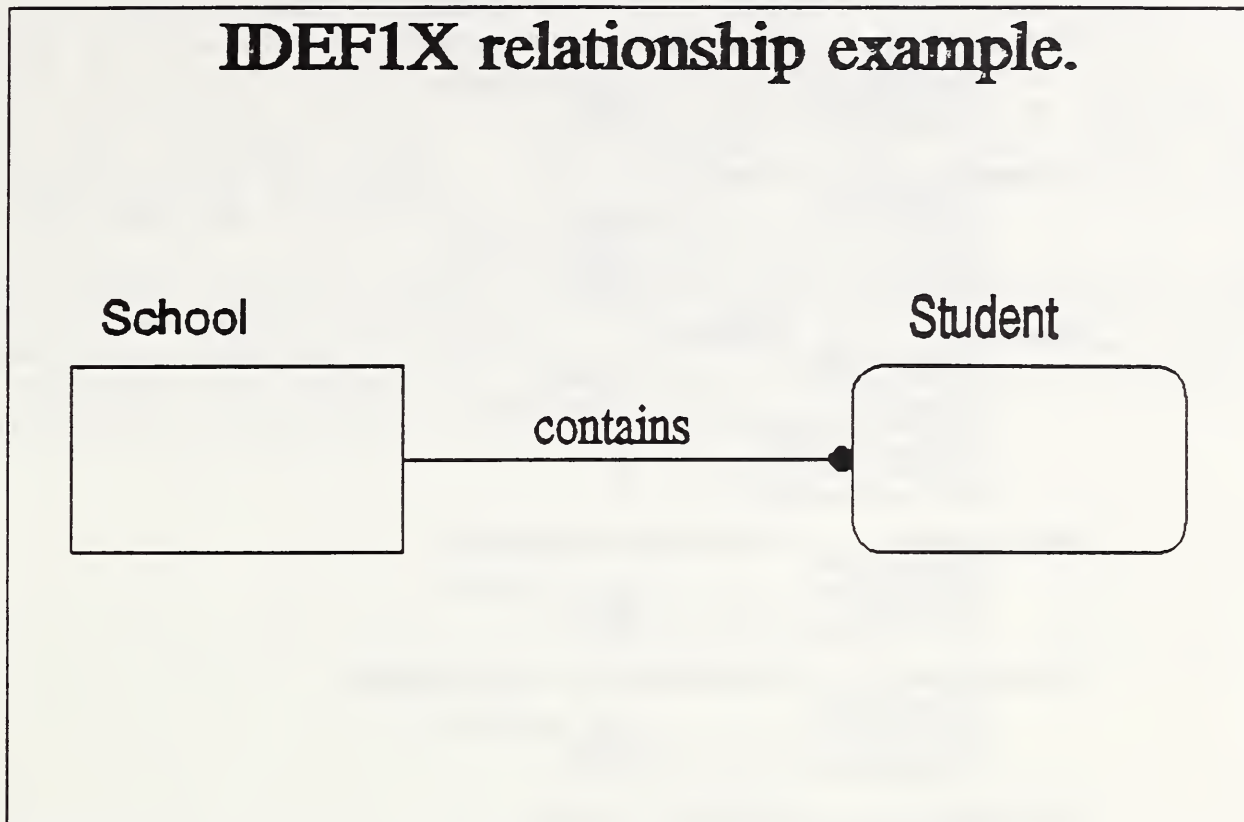
School —— 1 ◇contains◇ N —— Student
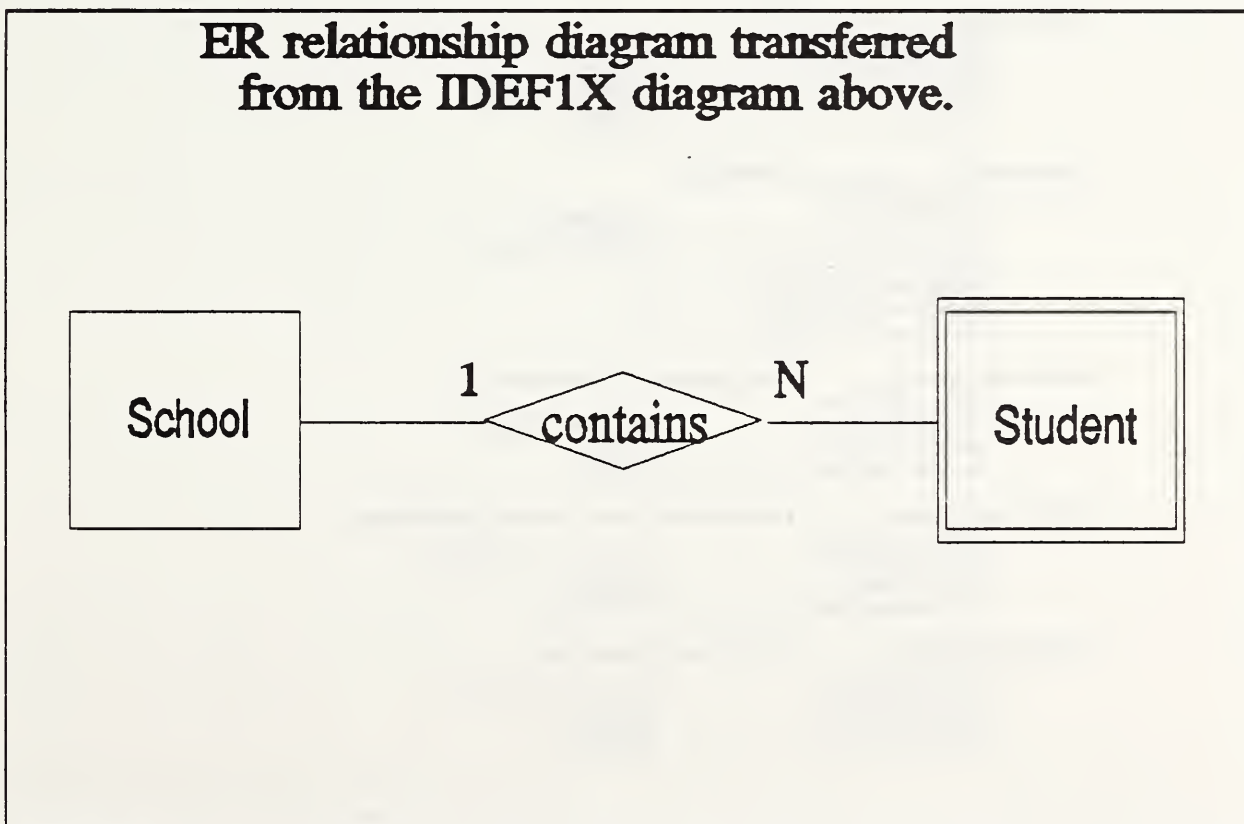
Figure 3

CDIF transfer form for the relationship "contains."

```
Meta-entity.................Relationship
      Meta-attributes
      CDIFIdentifier..................REL01
      Name............................"contains"
      BriefDescription................"This relationship relates a school to its students."

Meta-relationship..........DataModel.Collects.DataModelObjects
      Meta-attributes
      CDIFIdentifier..................DM_ICO_DMO01
      SourceEntity....................DM01
      DestinationEntity...............REL01

Meta-entity.................Role
      Meta-attributes
      CDIFIdentifier..................ROL01
      Name..........................."Parent_contains"
      IsMaster........................TRUE
      IsSource........................TRUE

Meta-entity.................RolePlayer
      Meta-attributes
      CDIFIdentifier..................ROLP01
      Name..........................."Parent_contains"
      MinInnerCardinality............."0"
      MaxInnerCardinality............."N"
      MinOuterCardinality............."1"
      MaxOuterCardinality............."1"

Meta-relationship..........Role.BelongsTo.Relationship
      Meta-attributes
      CDIFIdentifier..................ROL_BT_REL01
      SourceEntity....................ROL01
      DestinationEntity...............REL01

Meta-relationship..........DataModelObject.ActsAs.RolePlayer
      Meta-attributes
      CDIFIdentifier..................DMO_AA_ROLP01
      SourceEntity....................ENT01
      DestinationEntity...............ROLP01

Meta-relationship..........RolePlayer.Plays.Role
      Meta-attributes
      CDIFIdentifier..................ROLP_P_ROL01
      SourceEntity....................ROLP01
      DestinationEntity...............ROL01

Meta-entity.................Role
      Meta-attributes
      CDIFIdentifier..................ROL02
      Name..........................."Child_contains"
      IsMaster........................FALSE
      IsSource........................FALSE

Meta-entity.................RolePlayer
      Meta-attributes
      CDIFIdentifier..................ROLP02
      Name..........................."Child_contains"
      MinInnerCardinality............."1"
      MaxInnerCardinality............."1"
      MinOuterCardinality............."1"
      MaxOuterCardinality............."1"

Meta-relationship..........Role.BelongsTo.Relationship
      Meta-attributes
      CDIFIdentifier..................ROL_BT_REL02
      SourceEntity....................ROL02
      DestinationEntity...............REL01

Meta-relationship..........DataModelObject.ActsAs.RolePlayer
      Meta-attributes
      CDIFIdentifier..................DMO_AA_ROLP02
      SourceEntity....................ENT02
      DestinationEntity...............ROLP02

Meta-relationship..........RolePlayer.Plays.Role
      Meta-attributes
      CDIFIdentifier..................ROLP_P_ROL02
      SourceEntity....................ROLP02
      DestinationEntity...............ROL02
```

3.5 Issues

One issue of transfer formats is that there is no guarantee for 100% transfer of data. This occurs because one tool might not support all the concepts of another tool, in which case some information may be lost. Another situation would be if a tool handles multiple meanings of a concept of another tool. For example, one tool might have a classification of an entity as dependent or independent, while another tool just defines the concept of entity.

Another issue is that vendors currently are not implementing the CDIF Family of Standards. The reason is that most of the CDIF work has yet to be approved as official standards. Also tool vendors may have a difficult time realizing the benefit of using CDIF. Users of tools should stress the importance of having a standard transfer format.

4. DESCRIPTION OF MAPPING IDEF1X VIEW INTO CDIF TRANSFER FILE.

4.1 Data Model

For each IDEF1X data model it is necessary to define an instance of the CDIF meta-entity *DataModel*. In all cases throughout section 4 the reader should remember that all CDIF meta-entities and meta relationships must include the appropriate mandatory meta-attribute(s). In addition to the mandatory meta-attribute[1] the following optional inherited and local meta-attributes should be taken in consideration:

> *Name*
> *BriefDescription*
> *FullDescription*
> *DateCreated*
> *DateUpdated*
> *TimeCreated*
> *TimeUpdated*
> *LongName*
> *ModelType*.

---

[1]The mandatory meta-attribute *CDIFIdentifier* should be applied to ALL CDIF meta-entities and meta-relationships.

4.2 Entities

Define instances of the CDIF meta-entity *Entity*. There are some optional inherited and local meta-attributes which should be taken in consideration:

Inherited	Local
DateCreated	*Usage*
DateUpdated	*LongName*
TimeCreated	*EntityType*
TimeUpdated	
BriefDescription	
FullDescription	
Name	
SpecificationLanguage	
SpecificationText	
IsAbstract.	

In the example only *Name* and *EntityType* are used. The domain for *EntityType* consist of three values: Kernel, Characteristic, and Associative.

Kernel
This classification is used for an *Entity* whose instances are meaningful without the occurrences of other entities. For example, an instance of the *Entity*, having a name and a description, is significant without the knowledge of the data model to which it belongs. The fact that an *Entity* can be kernel does not imply that it can be uniquely identified without other scoping information.

Characteristic
Each instance of a characteristic *Entity* is logically related to a single instance of another entity. Therefore, the attributes could be considered to belong to the related entity, where the owning entity is related to the characteristic entity with a relationship with cardinality of 1:1.

Associative
This classification is used for an *Entity* whose existence is dependent upon the existence of two or more other entities. *Entity* instances cannot exist without the existence of instances of the related entity types.

Each instance of an *Entity* should be related to the data model to which it belongs. This is done using instances of the Meta-relationship *DataModel.Collects.DataModelObject*, where *DataModelObject* is just a supertype of *Entity*.

4.2.1 Identifier-Independent Entities

The CDIF local meta-attribute *EntityType* of *Entity* should be set to Kernel.

4.2.2 Identifier-Dependent Entities

The CDIF local meta-attribute *EntityType* of *Entity* should be set to Characteristic if each instance of the *Entity* is logically dependent on a single instance of another *Entity*.

The CDIF local meta-attribute *EntityType* of *Entity* should be set to Associative if each instance of the *Entity* is logically dependent on two or more instance of other *Entities*.

4.3 Relationships

Because IDEF1X Relationship is binary and CDIF Relationship is N-ary, we need to involve CDIF *Roles* (and *RolePlayers*) into the mapping.

For each IDEF1X Relationship (except Categorization):

1)   Define an instance of the CDIF meta-entity *Relationship*.

2)   Define an instance of the CDIF meta-relationship *DataModel.Collects.DataModelObject*, where *DataModelObject* is a supertype of Relationship.

3)   Define two instances of the CDIF meta-entity *Role* (one for the child entity and another for the parent entity).

4)   Define two instances of the CDIF meta-entity *RolePlayer* (one for the child entity and another for the parent entity).

5)   Define two instances for each of the following CDIF meta-relationships:
        Role.BelongsTo.Relationship,
        DataModelObject.ActsAs.RolePlayer, and
        RolePlayer.Plays.Role.

Each instance of *Role* should have at least the following attributes:

IsMaster
IsSource

Each instance of *RolePlayer* should have at least the following attributes:

MinInnerCardinality
MaxInnerCardinality
MinOuterCardinality
MaxOuterCardinality

All the other local and inherited meta-attributes are optional:

DateCreated
DateUpdated
TimeCreated
TimeUpdated
BriefDescription
FullDescription
Name
IsAbstract

4.3.1 Cardinality Mapping

a) All relationships (except Optional Non-Identifying):

Cardinality	Parent			
	Child			
Cardinality	MinInner	MaxInner	MinOuter	MaxOuter

|
  |
  * zero,one,or more
	0	N	1	1

	1	1	1	1
one or more P	1	N	1	1
	1	1	1	1
zero or one Z	0	1	1	1
	1	1	1	1
exactly n n	n	n	1	1
	1	1	1	1
from n to m n-m	n	m	1	1
	1	1	1	1
ref. to note (n) where card. is specified (n)	?	?	1	1
	1	1	1	1

? This field should be filled out according to the cardinality specified in the note (n). If it is not within the CDIF domain for *Min/MaxInnerCardinality*, put it as a note into *BriefDescription* of the *Role* or *RolePlayer*, or both.

b) Optional Non-Identifying):

| Cardinality | Parent | | | |
| | Child | | | |
	MinInner	MaxInner	MinOuter	MaxOuter
! ! * zero,one,or more	0	N	1	1
	0	1	1	1
one or more P	1	N	1	1
	0	1	1	1
zero or one Z	0	1	1	1
	0	1	1	1
exactly n n	n	n	1	1
	0	1	1	1
from n to m n-m	n	m	1	1
	0	1	1	1
ref. to note (n) where card. is specified (n)	?	?	1	1
	0	1	1	1

? This field should be filled out according to the cardinality specified in the note (n). If it is not within the CDIF domain for *Min/MaxInnerCardinality*, put it as a note into *BriefDescription* of the *Role* or *RolePlayer*, or both.

4.3.2 Identifying Connection Relationships (parent-child relationships)

Use the following chart to set the values for *IsMaster* and *IsSource* for each of two roles:

Attribute	Parent Role	Child Role
IsMaster	TRUE	FALSE
IsSource	TRUE	FALSE

4.3.3 Non-Identifying Connection Relationships

Use the following chart to set the values for *IsMaster* and *IsSource* for each of two roles:

Attribute	Parent Role	Child Role
IsMaster	TRUE	TRUE
IsSource	TRUE	FALSE

4.3.4 Categorization Relationships

CDIF does not provide a straight forward method for handling the IDEF1X concept of generalization/categorization. That's why we need to break this concept into two parts while mapping it to CDIF. The first part will transfer the concept of inheritance/subtyping, and the second part will create new instances of category entities with relationships to original category entities to present the concept of categorization from an IDEF1X point of view[1].

> For each IDEF1X Categorization (Complete and Incomplete) with one generic entity and n category entities:
>
> 1) Define an instance of the CDIF meta-entity *SubtypeSet*. All CDIF meta-attributes are optional except the boolean attribute *SubtypeListIsClosed*. If a IDEF1X Categorization is complete, set the attribute *SubtypeListIsClosed* to <u>True</u>. Otherwise, set it to <u>False</u>.
>
> 2) Define an instance of the CDIF meta-relationship *InheritableDataModelObject.IsSupertypeFor.SubtypeSet*, where *InheritableDataModelObject* is the generic entity.

---

[1]Refer to the appendix A for further explanations.

3)   Introduce and define n instances of the CDIF meta-entity *Entity*
      and act as if they were placed in between the generic entity
      and the category entities. All the attributes of the generic
      entity are inherited by those new entities.
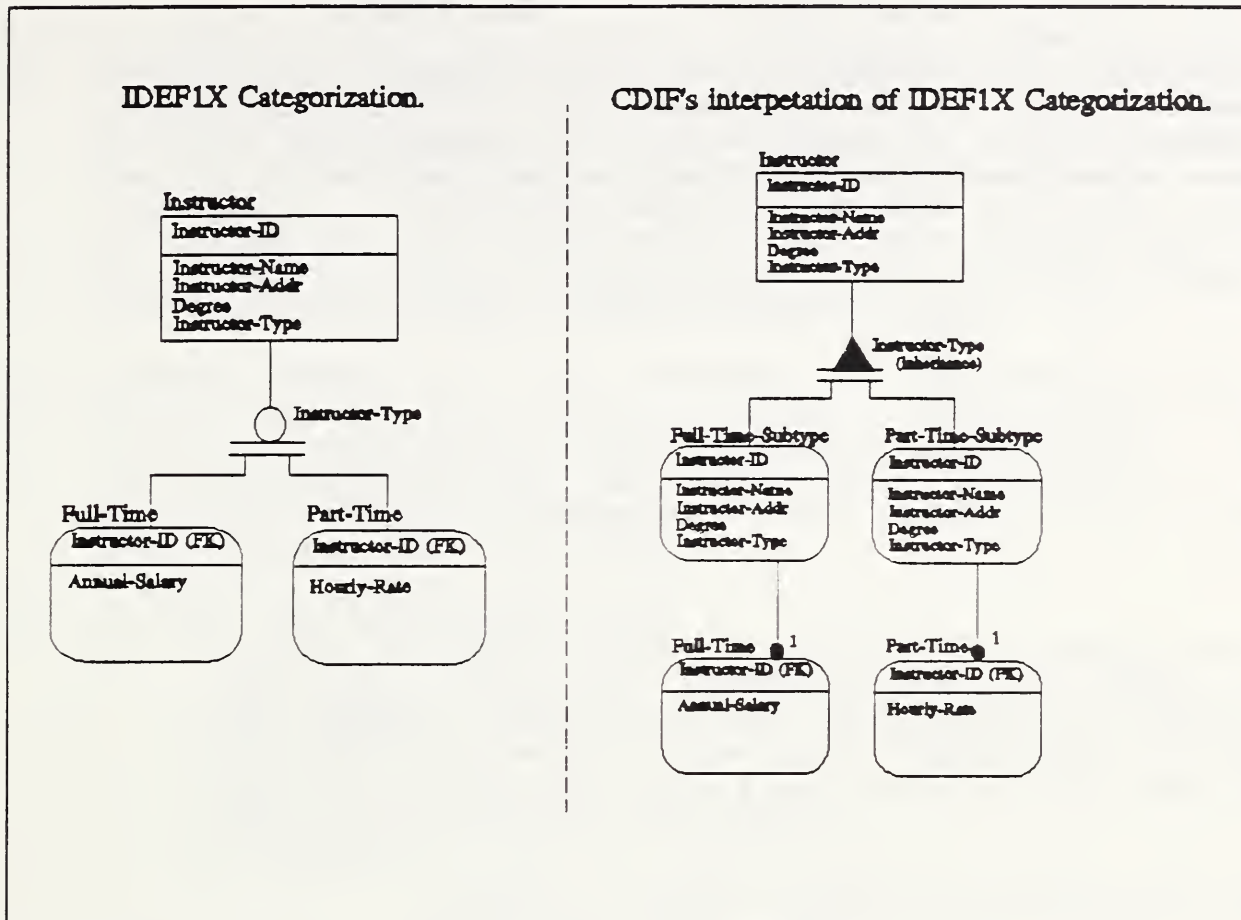
Figure 4

4)   Define all the attributes of the newly introduced entities
      following section 4.4.

5)   Define   n   instances   of   the   CDIF   meta-relationship
      InheritableDataModelObject.IsSubtypeIn.SubtypeSet, where each
      InheritableDataModelObject is one of the category[1] entities.

6)   If an IDEF1X Discriminator is defined, define an instance of
      the CDIF meta-relationship
      Attribute.IsDiscriminatorFor.SubtypeSet.

7)   Introduce and define all n relationships (sect. 4.3) from the
      newly defined entities to the original category entities. Those
      new relationships should be mandatory.

---

[1]The newly introduced entities have now became category
entities in the categorization, and the original category entities
have unnamed relationships to them.

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4.3.5 Non-Specific Relationships

Use the following chart to set the values for *IsMaster* and *IsSource* for each of two roles:

Attribute	Parent Role	Child Role
IsMaster	TRUE	TRUE
IsSource	TRUE	TRUE

4.4 Attributes/Keys

For an entity **E** with **p** attributes in the Primary Key, **f** Foreign Keys, **a** Alternate Keys, and **o** other attributes:

1) Define p+f+a+o instances of the CDIF meta-entity *Attribute*, one for each of the Attributes and Keys. If an attribute happened to be in the intersection of two keys (for example, ESSN could be in a primary key and a foreign key simultaneously), only one instance of it should be defined. If this attribute is either a foreign key from some other entity OR a foreign key to some other entity, do not put any value for the attribute *Name*. This value will be stored in *AttributeDefinition*.

2) Define p+f+a+o (or less, if there are intersections of keys) instances of the CDIF meta-relationship *AttributableObject.IsDescribedBy.Attribute*, where *AttributableObject* is just the entity E. There is a non-optional attribute *SequenceNo*, which represents the order of attributes within the entity.

3) For all the attributes of E:
   * Check if this attribute is either a foreign key from some other entity OR a foreign key to some other entity. For example, looking at the IDEF1X example diagram, the attribute Soc-Sec-No of the entity Enrollment is a part of the primary key, but it's also a foreign key from Student and a foreign key to Attendance.
   If it is:
       * Check if there exists an instance of the CDIF meta-entity *AttributeDefinition* for a particular attribute.
       If there is not:
           * Create an instance of the CDIF meta-entity *AttributeDefinition* for this attribute. Fill in a value for the CDIF meta-attribute *Name*.
       Create an instance of the CDIF meta-relationship *Attribute.IsBasedOn.AttributeDefinition* for this attribute.

4) Define one instance of the CDIF meta-entity *CandidateKey* for the Primary Key of E. The meta-attribute *IsPrimary* should be set to <u>True</u>.

5) Define one instance of the CDIF meta-entity *CandidateKey* for all the a Alternate Keys of E (if a is not 0). The meta-attribute *IsPrimary* should be set to <u>False</u>.

6) Define an instance of the CDIF meta-relationship *Entity.Contains.Key* for each of the *CandidateKeys*.

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7)   Define p+a instance(s) of the CDIF meta-relationship *Attribute.IsComponentOf.Key* for all the *CandidateKeys*. There is a need to have the attribute *SequenceNo*, which will allow you to match components of *ForeignKey* of E to components of *CandidateKey* of E', where E' is a parent in a particular relationship.

8)   Define an instance of the CDIF meta-entity *ForeignKey* for each relationship the entity E has migrated foreign keys from.

9)   Define an instance of the CDIF meta-relationship *Entity.Contains.Key* for each instance of *ForeignKey*.

10)   Define an instance of the CDIF meta-relationship *ForeignKey.References.CandidateKey*, where the *CandidateKey* comes from the parent (source) entity in this relationship.

11)   Define f instances of the CDIF meta-relationship *Attribute.IsComponentOf.Key*. Do not forget to put *SequenceNos* there! Be sure *SequenceNos* match those for the *Attribute.IsComponentOf.Key* of the *Attribute* migrated from, and be sure to put the *Attributes* into the right *ForeignKey*.

12)   If all the foreign keys from an entity migrated "above the Line," then define an instance of the CDIF meta-relationship *ForeignKey.IsComponentOf.CandidateKey*. And also stick *SequenceNos* there too.

4.5 Notes

There are four choices where to put notes. Pick one that best serves your needs.

A. Relationship Constraint

As a *RoleConstraint* with appropriate relationships with the *RolePlayers*.

1) Define an instance of the CDIF meta-entity *RoleConstraint*.

2) Define an instance of the CDIF meta-relationship *RoleConstraint.Contains.RolePlayer*, where *RolePlayer* plays *Role* in the relationship which is being constrained.

B. Domain Constraint

As a *ValueDomainGroup* with appropriate relationships with all (or some) *ValueDomains*.

1) Define an instance of the CDIF meta-entity *ValueDomainGroup*.

2) Define instance(s) of the CDIF meta-entities *ValueDomainEnumeration*, *ValueDomainRange*, *ValueDomainProcedure*, and *ValueDomainRule* as needed.

3) Define instance(s) of the CDIF meta-relationship *ValueDomainGroup.Contains.ValueDomain*, where *ValueDomain* is a supertype of all the ValueDomains above in 2).

4) Define instance(s) of the CDIF meta-relationship *ValueDomainGroup.Contains.ValueDomainGroup* if needed.

The Domains are specified in the CDIF Integrated Meta-model - Data Definition Subject Area, not in the Data Modeling Subject Area. To integrate between those areas some steps should be added to the mapping.

5) Define an instance of the CDIF meta-entity *DataElementType*.

6) Define an instance of the CDIF meta-relationship *Attribute.IsOccurrenceOf.DataElementType*, where *Attribute* is the *Attribute* with this Domain Constraint.

7) Define an instance of the CDIF meta-relationship *DataElementType.TakesValuesFrom.ValueDomainGroup* to finish the link between these Subject Areas.

C. Textual Constraint

1) Define an instance of the CDIF meta-entity *TextualConstraint*.

2) Define an instance of the CDIF meta-relationship *TextualConstraint.IsConstraintOn* *.SemanticInformationObject*, where *SemanticInformationObject* is a supertype of an *Attribute*.

D. Descriptional Constraint (Note)

Put this Constraint (note) in the meta-attribute *FullDescription* of a particular *Entity*.

5. EXAMPLE

5.1 Summary

This portion of the document is an example transfer of the contents of an IDEF1X model using CDIF Meta-model with the draft standard CDIF subject areas: Common, Data Modeling, and Data Definition. The chosen IDEF diagram contains the following IDEF1X semantic examples: Entity, Relationship (Identifying and Non-Identifying), Attributes, Key (Primary, Foreign), Categorization Relationship (Complete only), Cardinality, and Role. Most of the contents mapped relatively easy.

The one minor problem was transferring IDEF1X categorization relationship. Because CDIF does not implicitly support categorization, it had to be handled as CDIF subtyping in conjunction with additional relationships. IDEF categorization is different from the CDIF subtyping. CDIF subtyping does not have an instance of the generic entity, while IDEF1X categorization does. This means that the CDIF category entity physically inherits all the attributes and keys from its generic entity, while the IDEF category entity has the foreign keys migrated just from the primary keys of its generic entity.

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5.2 IDEF1X model.
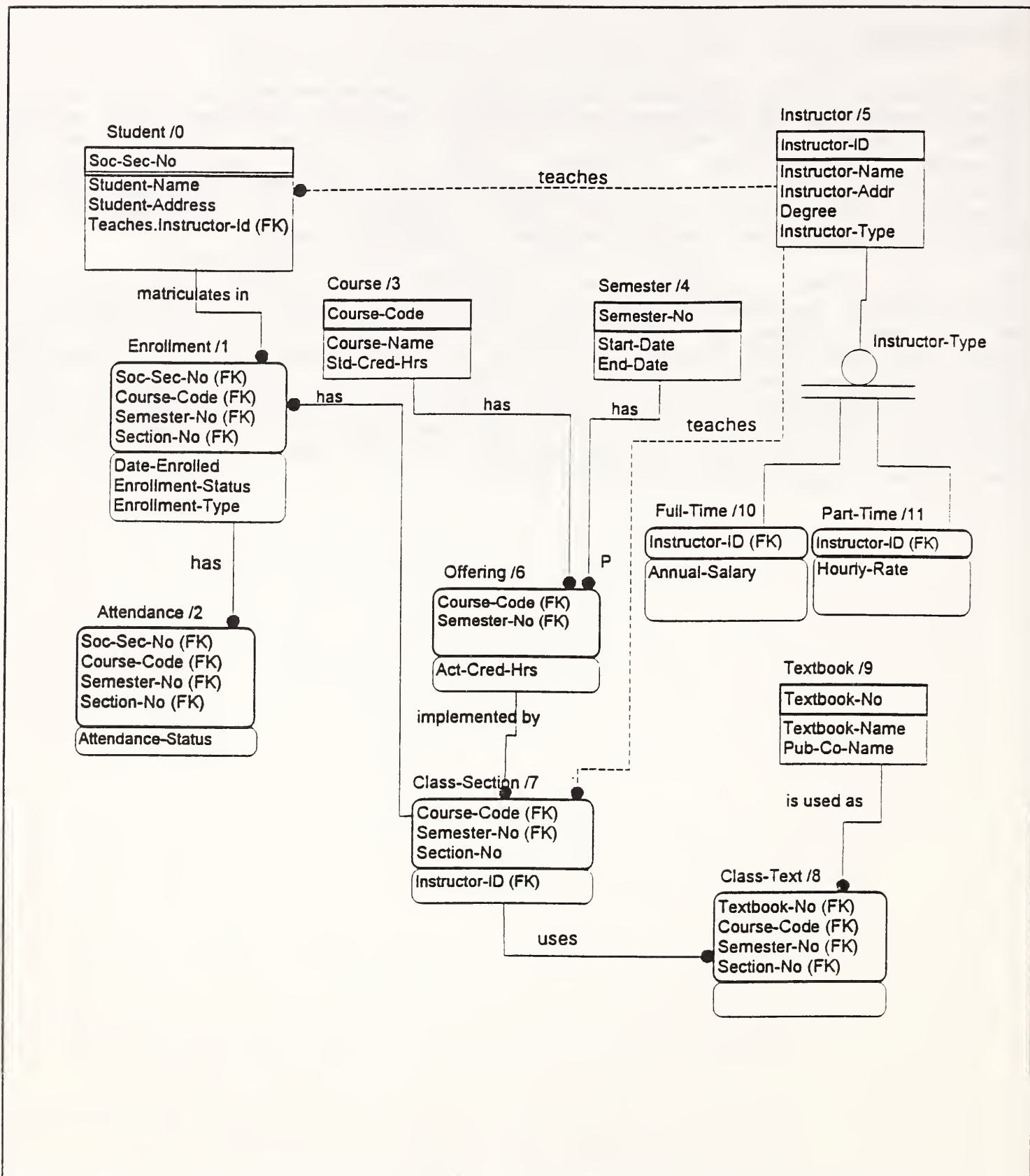
Figure 5

5.3 Data Model

```
Meta-entity..............DataModel
     Meta-attributes
     CDIFIdentifier..................SIM1_0
     Name............................"School-System"
     BriefDescription................"The first example Data
                                     Model."
     DateCreated.....................01-13-1994
     TimeCreated.....................11:59:59
```

5.4 Entities

```
Meta-entity................Entity
     Meta-attributes
     CDIFIdentifier..................SIM2_0
     Name............................"Student"
     EntityType......................Kernel

Meta-entity................Entity
     Meta-attributes
     CDIFIdentifier..................SIM2_1
     Name............................"Enrollment"
     EntityType......................Associative

Meta-entity................Entity
     Meta-attributes
     CDIFIdentifier..................SIM2_2
     Name............................"Attendance"
     EntityType......................Characteristic

Meta-entity................Entity
     Meta-attributes
     CDIFIdentifier..................SIM2_3
     Name............................"Course"
     EntityType......................Kernel

Meta-entity................Entity
     Meta-attributes
     CDIFIdentifier..................SIM2_4
     Name............................"Semester"
     EntityType......................Kernel

Meta-entity................Entity
     Meta-attributes
     CDIFIdentifier..................SIM2_5
     Name............................"Instructor"
     EntityType......................Kernel

Meta-entity................Entity
     Meta-attributes
     CDIFIdentifier..................SIM2_6
     Name............................"Offering"
     EntityType......................Associative

Meta-entity................Entity
     Meta-attributes
     CDIFIdentifier..................SIM2_7
     Name............................"Class-Section"
     EntityType......................Characteristic
```

```
Meta-entity................Entity
     Meta-attributes
     CDIFIdentifier...................SIM2_8
     Name.............................."Class-Text"
     EntityType.......................Associative

Meta-entity................Entity
     Meta-attributes
     CDIFIdentifier...................SIM2_9
     Name.............................."Textbook"
     EntityType.......................Kernel

Meta-entity................Entity
     Meta-attributes
     CDIFIdentifier...................SIM2_10
     Name.............................."Full-Time-Subtype"
     EntityType.......................Kernel

Meta-entity................Entity
     Meta-attributes
     CDIFIdentifier...................SIM2_11
     Name.............................."Part-Time-Subtype"
     EntityType.......................Kernel
```

Both entities "Full-Time-Subtype" and "Part-Time-Subtype" are needed to present the whole meaning of the categorization.[1]

```
Meta-entity................Entity
     Meta-attributes
     CDIFIdentifier...................SIM2_12
     Name.............................."Full-Time"
     EntityType.......................Characteristic

Meta-entity................Entity
     Meta-attributes
     CDIFIdentifier...................SIM2_13
     Name.............................."Part-Time"
     EntityType.......................Characteristic
```

Each of the entities needs to be related to the data model to which it belongs. This is done using instances of the Meta-relationship *DataModel.Collects.DataModelObject*, which is inherited because *Entity* is a descendant of *DataModelObject*.

```
Meta-relationship.........DataModel.Collects.DataModelObject
     Meta-attributes
     CDIFIdentifier...................SIM3_0
     SourceEntity.....................SIM1_0
     DestinationEntity................SIM2_0

Meta-relationship.........DataModel.Collects.DataModelObject
     Meta-attributes
     CDIFIdentifier...................SIM3_1
     SourceEntity.....................SIM1_0
     DestinationEntity................SIM2_1
```

---

[1] Small font is used for comments throughout this section.

```
Meta-relationship.........DataModel.Collects.DataModelObject
     Meta-attributes
     CDIFIdentifier...................SIM3_2
     SourceEntity.....................SIM1_0
     DestinationEntity................SIM2_2

Meta-relationship.........DataModel.Collects.DataModelObject
     Meta-attributes
     CDIFIdentifier...................SIM3_3
     SourceEntity.....................SIM1_0
     DestinationEntity................SIM2_3

Meta-relationship.........DataModel.Collects.DataModelObject
     Meta-attributes
     CDIFIdentifier...................SIM3_4
     SourceEntity.....................SIM1_0
     DestinationEntity................SIM2_4

Meta-relationship.........DataModel.Collects.DataModelObject
     Meta-attributes
     CDIFIdentifier...................SIM3_5
     SourceEntity.....................SIM1_0
     DestinationEntity................SIM2_5

Meta-relationship.........DataModel.Collects.DataModelObject
     Meta-attributes
     CDIFIdentifier...................SIM3_6
     SourceEntity.....................SIM1_0
     DestinationEntity................SIM2_6

Meta-relationship.........DataModel.Collects.DataModelObject
     Meta-attributes
     CDIFIdentifier...................SIM3_7
     SourceEntity.....................SIM1_0
     DestinationEntity................SIM2_7

Meta-relationship.........DataModel.Collects.DataModelObject
     Meta-attributes
     CDIFIdentifier...................SIM3_8
     SourceEntity.....................SIM1_0
     DestinationEntity................SIM2_8

Meta-relationship.........DataModel.Collects.DataModelObject
     Meta-attributes
     CDIFIdentifier...................SIM3_9
     SourceEntity.....................SIM1_0
     DestinationEntity................SIM2_9

Meta-relationship.........DataModel.Collects.DataModelObject
     Meta-attributes
     CDIFIdentifier...................SIM3_10
     SourceEntity.....................SIM1_0
     DestinationEntity................SIM2_10
```

```
Meta-relationship.........DataModel.Collects.DataModelObject
     Meta-attributes
     CDIFIdentifier...................SIM3_11
     SourceEntity.....................SIM1_0
     DestinationEntity................SIM2_11

Meta-relationship.........DataModel.Collects.DataModelObject
     Meta-attributes
     CDIFIdentifier...................SIM3_12
     SourceEntity.....................SIM1_0
     DestinationEntity................SIM2_12

Meta-relationship.........DataModel.Collects.DataModelObject
     Meta-attributes
     CDIFIdentifier...................SIM3_13
     SourceEntity.....................SIM1_0
     DestinationEntity................SIM2_13
```

5.5 Subtyping (as a part of categorization)

```
Meta-entity................SubtypeSet
     Meta-attributes
     CDIFIdentifier...................SIM4_1
     Name.............................."Instructor-TypeSet"
     SubtypeListIsClosed..............True
     BriefDescription................."This defines the subtyping
                                        of Instructor"

Meta-relationship.........InheritableDataModelObject.IsSupertypeFor
                          .SubtypeSet
     Meta-attributes
     CDIFIdentifier...................SIM4_11
     SourceEntity.....................SIM2_5
     DestinationEntity...............SIM4_1

Meta-relationship.........InheritableDataModelObject.IsSubtypeIn
                          .SubtypeSet
     Meta-attributes
     CDIFIdentifier...................SIM4_12
     SourceEntity.....................SIM2_10
     DestinationEntity...............SIM4_1

Meta-relationship.........InheritableDataModelObject.IsSubtypeIn
                          .SubtypeSet
     Meta-attributes
     CDIFIdentifier...................SIM4_13
     SourceEntity.....................SIM2_11
     DestinationEntity...............SIM4_1

Meta-relationship.........Attribute.IsDiscriminatorFor.SubtypeSet
     Meta-attributes
     CDIFIdentifier...................SIM4_14
     SourceEntity.....................SIM6_33 /*Instruction-Type*/
     DestinationEntity...............SIM4_1
```

5.6 Relationships

```
Meta-entity...............Relationship
      Meta-attributes
      CDIFIdentifier...................SIM5_0
      Name............................"matriculates in"
      BriefDescription................"This relates a Student to
                                       the Enrollment of this
                                       Student."

Meta-relationship.........DataModel.Collects.DataModelObject
      Meta-attributes
      CDIFIdentifier...................SIM5_01
      SourceEntity.....................SIM1_0
      DestinationEntity................SIM5_0

Meta-entity...............Role
      Meta-attributes
      CDIFIdentifier...................SIM5_02A
      Name............................"Parent_matriculates_in_0"
      IsMaster........................True
      IsSource........................True

Meta-entity...............RolePlayer
      Meta-attributes
      CDIFIdentifier...................SIM5_03A
      Name............................"Student-Parent"
      MinInnerCardinality.............."0"
      MaxInnerCardinality............."N"
      MinOuterCardinality............."1"
      MaxOuterCardinality............."1"

Meta-relationship.........Role.BelongsTo.Relationship
      Meta-attributes
      CDIFIdentifier...................SIM5_04A
      SourceEntity.....................SIM5_02A
      DestinationEntity................SIM5_0

Meta-relationship.........DataModelObject.ActsAs.RolePlayer
      Meta-attributes
      CDIFIdentifier...................SIM5_05A
      SourceEntity.....................SIM2_0
      DestinationEntity................SIM5_03A

Meta-relationship.........RolePlayer.Plays.Role
      Meta-attributes
      CDIFIdentifier...................SIM5_06A
      SourceEntity.....................SIM5_03A
      DestinationEntity................SIM5_02A
```

```
Meta-entity...............Role
     Meta-attributes
     CDIFIdentifier...................SIM5_02B
     Name.............................."Child_matriculates_in_0"
     IsMaster.........................False
     IsSource.........................False

Meta-entity...............RolePlayer
     Meta-attributes
     CDIFIdentifier...................SIM5_03B
     Name.............................."Enrollment-Child"
     MinInnerCardinality.............."1"
     MaxInnerCardinality.............."1"
     MinOuterCardinality.............."1"
     MaxOuterCardinality.............."1"

Meta-relationship.........Role.BelongsTo.Relationship
     Meta-attributes
     CDIFIdentifier...................SIM5_04B
     SourceEntity.....................SIM5_02B
     DestinationEntity................SIM5_0

Meta-relationship.........DataModelObject.ActsAs.RolePlayer
     Meta-attributes
     CDIFIdentifier...................SIM5_05B
     SourceEntity.....................SIM2_1
     DestinationEntity................SIM5_03B

Meta-relationship.........RolePlayer.Plays.Role
     Meta-attributes
     CDIFIdentifier...................SIM5_06B
     SourceEntity.....................SIM5_03B
     DestinationEntity................SIM5_02B
```

```
Meta-entity.............Relationship
    Meta-attributes
    CDIFIdentifier..................SIM5_1
    Name............................"has"
    BriefDescription................"This relates a Class-Section
                                    to the Enrollment."

Meta-relationship.........DataModel.Collects.DataModelObject
    Meta-attributes
    CDIFIdentifier..................SIM5_11
    SourceEntity....................SIM1_0
    DestinationEntity...............SIM5_1

Meta-entity.............Role
    Meta-attributes
    CDIFIdentifier..................SIM5_12A
    Name............................"Parent_has_1"
    IsMaster........................True
    IsSource........................True

Meta-entity.............RolePlayer
    Meta-attributes
    CDIFIdentifier..................SIM5_13A
    Name............................"Class-Section_Parent"
    MinInnerCardinality.............."0"
    MaxInnerCardinality.............."N"
    MinOuterCardinality.............."1"
    MaxOuterCardinality.............."1"

Meta-relationship.........Role.BelongsTo.Relationship
    Meta-attributes
    CDIFIdentifier..................SIM5_14A
    SourceEntity....................SIM5_12A
    DestinationEntity...............SIM5_1

Meta-relationship.........DataModelObject.ActsAs.RolePlayer
    Meta-attributes
    CDIFIdentifier..................SIM5_15A
    SourceEntity....................SIM2_7
    DestinationEntity...............SIM5_13A

Meta-relationship.........RolePlayer.Plays.Role
    Meta-attributes
    CDIFIdentifier..................SIM5_16A
    SourceEntity....................SIM5_13A
    DestinationEntity...............SIM5_12A
```

```
Meta-entity................Role
     Meta-attributes
     CDIFIdentifier...................SIM5_12B
     Name.............................."Child_has_1"
     IsMaster..........................False
     IsSource..........................False

Meta-entity................RolePlayer
     Meta-attributes
     CDIFIdentifier...................SIM5_13B
     Name............................."Enrollment_Child"
     MinInnerCardinality.............."1"
     MaxInnerCardinality.............."1"
     MinOuterCardinality.............."1"
     MaxOuterCardinality.............."1"

Meta-relationship.........Role.BelongsTo.Relationship
     Meta-attributes
     CDIFIdentifier...................SIM5_14B
     SourceEntity.....................SIM5_12B
     DestinationEntity................SIM5_1

Meta-relationship.........DataModelObject.ActsAs.RolePlayer
     Meta-attributes
     CDIFIdentifier...................SIM5_15B
     SourceEntity.....................SIM2_1
     DestinationEntity................SIM5_13B

Meta-relationship.........RolePlayer.Plays.Role
     Meta-attributes
     CDIFIdentifier...................SIM5_16B
     SourceEntity.....................SIM5_13B
     DestinationEntity................SIM5_12B
```

```
Meta-entity...............Relationship
     Meta-attributes
     CDIFIdentifier...................SIM5_2
     Name.............................."has"
     BriefDescription................."This relates an Enrollment
                                       to the Attendance."

Meta-relationship.........DataModel.Collects.DataModelObject
     Meta-attributes
     CDIFIdentifier...................SIM5_21
     SourceEntity.....................SIM1_0
     DestinationEntity................SIM5_2

Meta-entity...............Role
     Meta-attributes
     CDIFIdentifier...................SIM5_22A
     Name............................."Parent_has_2"
     IsMaster.........................True
     IsSource.........................True

Meta-entity...............RolePlayer
     Meta-attributes
     CDIFIdentifier...................SIM5_23A
     Name............................."Enrollment_Parent"
     MinInnerCardinality.............."0"
     MaxInnerCardinality.............."N"
     MinOuterCardinality.............."1"
     MaxOuterCardinality.............."1"

Meta-relationship.........Role.BelongsTo.Relationship
     Meta-attributes
     CDIFIdentifier...................SIM5_24A
     SourceEntity.....................SIM5_22A
     DestinationEntity................SIM5_2

Meta-relationship.........DataModelObject.ActsAs.RolePlayer
     Meta-attributes
     CDIFIdentifier...................SIM5_25A
     SourceEntity.....................SIM2_1
     DestinationEntity................SIM5_23A

Meta-relationship.........RolePlayer.Plays.Role
     Meta-attributes
     CDIFIdentifier...................SIM5_26A
     SourceEntity.....................SIM5_23A
     DestinationEntity................SIM5_22A
```

```
Meta-entity...............Role
     Meta-attributes
     CDIFIdentifier...................SIM5_22B
     Name.............................."Child_has_2"
     IsMaster..........................False
     IsSource..........................False

Meta-entity...............RolePlayer
     Meta-attributes
     CDIFIdentifier...................SIM5_23B
     Name............................."Attendance_Child"
     MinInnerCardinality..............."1"
     MaxInnerCardinality..............."1"
     MinOuterCardinality..............."1"
     MaxOuterCardinality..............."1"

Meta-relationship.........Role.BelongsTo.Relationship
     Meta-attributes
     CDIFIdentifier...................SIM5_24B
     SourceEntity.....................SIM5_22B
     DestinationEntity................SIM5_2

Meta-relationship.........DataModelObject.ActsAs.RolePlayer
     Meta-attributes
     CDIFIdentifier...................SIM5_25B
     SourceEntity.....................SIM2_2
     DestinationEntity................SIM5_23B

Meta-relationship.........RolePlayer.Plays.Role
     Meta-attributes
     CDIFIdentifier...................SIM5_26B
     SourceEntity.....................SIM5_23B
     DestinationEntity................SIM5_22B
```

```
Meta-entity................Relationship
     Meta-attributes
     CDIFIdentifier...................SIM5_3
     Name.............................."has"
     BriefDescription................."This relates a Course to the
                                       Offering."

Meta-relationship.........DataModel.Collects.DataModelObject
     Meta-attributes
     CDIFIdentifier...................SIM5_31
     SourceEntity.....................SIM1_0
     DestinationEntity................SIM5_3

Meta-entity................Role
     Meta-attributes
     CDIFIdentifier...................SIM5_32A
     Name.............................."Parent_has_3"
     IsMaster.........................True
     IsSource.........................True

Meta-entity................RolePlayer
     Meta-attributes
     CDIFIdentifier...................SIM5_33A
     Name.............................."Course_Parent"
     MinInnerCardinality.............."0"
     MaxInnerCardinality.............."N"
     MinOuterCardinality.............."1"
     MaxOuterCardinality.............."1"

Meta-relationship.........Role.BelongsTo.Relationship
     Meta-attributes
     CDIFIdentifier...................SIM5_34A
     SourceEntity.....................SIM5_32A
     DestinationEntity................SIM5_3

Meta-relationship.........DataModelObject.ActsAs.RolePlayer
     Meta-attributes
     CDIFIdentifier...................SIM5_35A
     SourceEntity.....................SIM2_3
     DestinationEntity................SIM5_33A

Meta-relationship.........RolePlayer.Plays.Role
     Meta-attributes
     CDIFIdentifier...................SIM5_36A
     SourceEntity.....................SIM5_33A
     DestinationEntity................SIM5_32A
```

```
Meta-entity...............Role
     Meta-attributes
     CDIFIdentifier...................SIM5_32B
     Name.............................."Child_has_3"
     IsMaster.........................False
     IsSource.........................False

Meta-entity...............RolePlayer
     Meta-attributes
     CDIFIdentifier...................SIM5_33B
     Name.............................."Offering_Child"
     MinInnerCardinality.............."1"
     MaxInnerCardinality.............."1"
     MinOuterCardinality.............."1"
     MaxOuterCardinality.............."1"

Meta-relationship.........Role.BelongsTo.Relationship
     Meta-attributes
     CDIFIdentifier...................SIM5_34B
     SourceEntity.....................SIM5_32B
     DestinationEntity................SIM5_3

Meta-relationship.........DataModelObject.ActsAs.RolePlayer
     Meta-attributes
     CDIFIdentifier...................SIM5_35B
     SourceEntity.....................SIM2_6
     DestinationEntity................SIM5_33B

Meta-relationship.........RolePlayer.Plays.Role
     Meta-attributes
     CDIFIdentifier...................SIM5_36B
     SourceEntity.....................SIM5_33B
     DestinationEntity................SIM5_32B
```

```
Meta-entity..............Relationship
     Meta-attributes
     CDIFIdentifier...................SIM5_4
     Name.............................."has"
     BriefDescription.................."This relates a Semester to
                                       the Offering."

Meta-relationship........DataModel.Collects.DataModelObject
     Meta-attributes
     CDIFIdentifier...................SIM5_41
     SourceEntity.....................SIM1_0
     DestinationEntity................SIM5_4

Meta-entity..............Role
     Meta-attributes
     CDIFIdentifier...................SIM5_42A
     Name............................."Parent_has_4"
     IsMaster.........................True
     IsSource.........................True

Meta-entity..............RolePlayer
     Meta-attributes
     CDIFIdentifier...................SIM5_43A
     Name............................."Semester_Parent"
     MinInnerCardinality.............."1"
     MaxInnerCardinality.............."N"
     MinOuterCardinality.............."1"
     MaxOuterCardinality.............."1"

Meta-relationship........Role.BelongsTo.Relationship
     Meta-attributes
     CDIFIdentifier...................SIM5_44A
     SourceEntity.....................SIM5_42A
     DestinationEntity................SIM5_4

Meta-relationship........DataModelObject.ActsAs.RolePlayer
     Meta-attributes
     CDIFIdentifier...................SIM5_45A
     SourceEntity.....................SIM2_4
     DestinationEntity................SIM5_43A

Meta-relationship........RolePlayer.Plays.Role
     Meta-attributes
     CDIFIdentifier...................SIM5_46A
     SourceEntity.....................SIM5_43A
     DestinationEntity................SIM5_42A
```

```
Meta-entity...............Role
      Meta-attributes
      CDIFIdentifier...................SIM5_42B
      Name..............................."Child_has_4"
      IsMaster..........................False
      IsSource..........................False

Meta-entity...............RolePlayer
      Meta-attributes
      CDIFIdentifier...................SIM5_43B
      Name..............................."Offering_child"
      MinInnerCardinality..............."1"
      MaxInnerCardinality..............."1"
      MinOuterCardinality..............."1"
      MaxOuterCardinality..............."1"

Meta-relationship.........Role.BelongsTo.Relationship
      Meta-attributes
      CDIFIdentifier...................SIM5_44B
      SourceEntity.....................SIM5_42B
      DestinationEntity................SIM5_4

Meta-relationship.........DataModelObject.ActsAs.RolePlayer
      Meta-attributes
      CDIFIdentifier...................SIM5_45B
      SourceEntity.....................SIM2_6
      DestinationEntity................SIM5_43B

Meta-relationship.........RolePlayer.Plays.Role
      Meta-attributes
      CDIFIdentifier...................SIM5_46B
      SourceEntity.....................SIM5_43B
      DestinationEntity................SIM5_42B
```

```
Meta-entity...............Relationship
      Meta-attributes
      CDIFIdentifier..................SIM5_5
      Name............................"teaches"
      BriefDescription................"This relates an Instructor
                                       to the Student."

Meta-relationship.........DataModel.Collects.DataModelObject
      Meta-attributes
      CDIFIdentifier..................SIM5_51
      SourceEntity....................SIM1_0
      DestinationEntity...............SIM5_5

Meta-entity...............Role
      Meta-attributes
      CDIFIdentifier..................SIM5_52A
      Name............................"Parent_teaches_6"
      IsMaster........................True
      IsSource........................True

Meta-entity...............RolePlayer
      Meta-attributes
      CDIFIdentifier..................SIM5_53A
      Name............................"Instructor_Parent"
      MinInnerCardinality............."0"
      MaxInnerCardinality............."N"
      MinOuterCardinality............."1"
      MaxOuterCardinality............."1"

Meta-relationship.........Role.BelongsTo.Relationship
      Meta-attributes
      CDIFIdentifier..................SIM5_54A
      SourceEntity....................SIM5_52A
      DestinationEntity...............SIM5_5

Meta-relationship.........DataModelObject.ActsAs.RolePlayer
      Meta-attributes
      CDIFIdentifier..................SIM5_55A
      SourceEntity....................SIM2_5
      DestinationEntity...............SIM5_53A

Meta-relationship.........RolePlayer.Plays.Role
      Meta-attributes
      CDIFIdentifier..................SIM5_56A
      SourceEntity....................SIM5_53A
      DestinationEntity...............SIM5_52A
```

```
Meta-entity...............Role
      Meta-attributes
      CDIFIdentifier...................SIM5_52B
      Name.............................."Child_teaches_6"
      IsMaster.........................True²
      IsSource.........................False

Meta-entity...............RolePlayer
      Meta-attributes
      CDIFIdentifier...................SIM5_53B
      Name.............................."Student_Child"
      MinInnerCardinality.............."0"
      MaxInnerCardinality.............."1"
      MinOuterCardinality.............."1"
      MaxOuterCardinality.............."1"

Meta-relationship.........Role.BelongsTo.Relationship
      Meta-attributes
      CDIFIdentifier...................SIM5_54B
      SourceEntity.....................SIM5_52B
      DestinationEntity................SIM5_5

Meta-relationship.........DataModelObject.ActsAs.RolePlayer
      Meta-attributes
      CDIFIdentifier...................SIM5_55B
      SourceEntity.....................SIM2_0
      DestinationEntity................SIM5_53B

Meta-relationship.........RolePlayer.Plays.Role
      Meta-attributes
      CDIFIdentifier...................SIM5_56B
      SourceEntity.....................SIM5_53B
      DestinationEntity................SIM5_52B
```

---

[2]Since this is a Non-Identifying Connection Relationship, both entities do not depend either on the relation nor on each other, so both of them are masters.

```
Meta-entity..............Relationship
     Meta-attributes
     CDIFIdentifier..................SIM5_6
     Name............................"teaches"
     BriefDescription................"This relates an Instructor
                                      to the Class-Section."

Meta-relationship........DataModel.Collects.DataModelObject
     Meta-attributes
     CDIFIdentifier..................SIM5_61
     SourceEntity....................SIM1_0
     DestinationEntity...............SIM5_6

Meta-entity..............Role
     Meta-attributes
     CDIFIdentifier..................SIM5_62A
     Name............................"Parent_teaches_7"
     IsMaster........................True
     IsSource........................True

Meta-entity..............RolePlayer
     Meta-attributes
     CDIFIdentifier..................SIM5_63A
     Name............................"Instructor_Parent"
     MinInnerCardinality.............."0"
     MaxInnerCardinality............."N"
     MinOuterCardinality............."1"
     MaxOuterCardinality............."1"

Meta-relationship........Role.BelongsTo.Relationship
     Meta-attributes
     CDIFIdentifier..................SIM5_64A
     SourceEntity....................SIM5_62A
     DestinationEntity...............SIM5_6

Meta-relationship........DataModelObject.ActsAs.RolePlayer
     Meta-attributes
     CDIFIdentifier..................SIM5_65A
     SourceEntity....................SIM2_5
     DestinationEntity...............SIM5_63A

Meta-relationship........RolePlayer.Plays.Role
     Meta-attributes
     CDIFIdentifier..................SIM5_66A
     SourceEntity....................SIM5_63A
     DestinationEntity...............SIM5_62A
```

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```
Meta-entity..............Role
     Meta-attributes
     CDIFIdentifier..................SIM5_62B
     Name............................"Child_teaches_7"
     IsMaster........................True[1]
     IsSource........................False

Meta-entity..............RolePlayer
     Meta-attributes
     CDIFIdentifier..................SIM5_63B
     Name............................"Class-Section_Child"
     MinInnerCardinality.............."0"
     MaxInnerCardinality.............."1"
     MinOuterCardinality.............."1"
     MaxOuterCardinality.............."1"

Meta-relationship.........Role.BelongsTo.Relationship
     Meta-attributes
     CDIFIdentifier..................SIM5_64B
     SourceEntity....................SIM5_62B
     DestinationEntity...............SIM5_6

Meta-relationship.........DataModelObject.ActsAs.RolePlayer
     Meta-attributes
     CDIFIdentifier..................SIM5_65B
     SourceEntity....................SIM2_7
     DestinationEntity...............SIM5_63B

Meta-relationship.........RolePlayer.Plays.Role
     Meta-attributes
     CDIFIdentifier..................SIM5_66B
     SourceEntity....................SIM5_63B
     DestinationEntity...............SIM5_62B
```

---

[1]Since this is a Non-Identifying Connection Relationship, both entities do not depend either on the relation nor on each other, so both of them are masters.

```
Meta-entity................Relationship
     Meta-attributes
     CDIFIdentifier...................SIM5_7
     Name............................."implemented by"
     BriefDescription................."This relates an Offering to
                                      the Class-Section."

Meta-relationship.........DataModel.Collects.DataModelObject
     Meta-attributes
     CDIFIdentifier...................SIM5_71
     SourceEntity.....................SIM1_0
     DestinationEntity................SIM5_7

Meta-entity................Role
     Meta-attributes
     CDIFIdentifier...................SIM5_72A
     Name............................."Parent_implemented_by_7"
     IsMaster.........................True
     IsSource.........................True

Meta-entity................RolePlayer
     Meta-attributes
     CDIFIdentifier...................SIM5_73A
     Name............................."Offering_Parent"
     MinInnerCardinality............."0"
     MaxInnerCardinality............."N"
     MinOuterCardinality............."1"
     MaxOuterCardinality............."1"

Meta-relationship.........Role.BelongsTo.Relationship
     Meta-attributes
     CDIFIdentifier...................SIM5_74A
     SourceEntity.....................SIM5_72A
     DestinationEntity................SIM5_7

Meta-relationship.........DataModelObject.ActsAs.RolePlayer
     Meta-attributes
     CDIFIdentifier...................SIM5_75A
     SourceEntity.....................SIM2_6
     DestinationEntity................SIM5_73A

Meta-relationship.........RolePlayer.Plays.Role
     Meta-attributes
     CDIFIdentifier...................SIM5_76A
     SourceEntity.....................SIM5_73A
     DestinationEntity................SIM5_72A
```

```
Meta-entity...............Role
     Meta-attributes
     CDIFIdentifier...................SIM5_72B
     Name.............................."Child_implemented_by_7"
     IsMaster.........................False
     IsSource.........................False

Meta-entity...............RolePlayer
     Meta-attributes
     CDIFIdentifier...................SIM5_73B
     Name.............................."Class-Section_Child"
     MinInnerCardinality.............."1"
     MaxInnerCardinality.............."1"
     MinOuterCardinality.............."1"
     MaxOuterCardinality.............."1"

Meta-relationship.........Role.BelongsTo.Relationship
     Meta-attributes
     CDIFIdentifier...................SIM5_74B
     SourceEntity.....................SIM5_72B
     DestinationEntity................SIM5_7

Meta-relationship.........DataModelObject.ActsAs.RolePlayer
     Meta-attributes
     CDIFIdentifier...................SIM5_75B
     SourceEntity.....................SIM2_7
     DestinationEntity................SIM5_73B

Meta-relationship.........RolePlayer.Plays.Role
     Meta-attributes
     CDIFIdentifier...................SIM5_76B
     SourceEntity.....................SIM5_73B
     DestinationEntity................SIM5_72B
```

```
Meta-entity..............Relationship
     Meta-attributes
     CDIFIdentifier...................SIM5_8
     Name.............................."uses"
     BriefDescription................."This relates a Class-Section
                                       to the Class-Text."

Meta-relationship.........DataModel.Collects.DataModelObject
     Meta-attributes
     CDIFIdentifier...................SIM5_81
     SourceEntity.....................SIM1_0
     DestinationEntity................SIM5_8

Meta-entity..............Role
     Meta-attributes
     CDIFIdentifier...................SIM5_82A
     Name............................."Parent_uses_8"
     IsMaster.........................True
     IsSource.........................True

Meta-entity..............RolePlayer
     Meta-attributes
     CDIFIdentifier...................SIM5_83A
     Name............................."Class-Section_Parent"
     MinInnerCardinality.............."0"
     MaxInnerCardinality.............."N"
     MinOuterCardinality.............."1"
     MaxOuterCardinality.............."1"

Meta-relationship.........Role.BelongsTo.Relationship
     Meta-attributes
     CDIFIdentifier...................SIM5_84A
     SourceEntity.....................SIM5_82A
     DestinationEntity................SIM5_8

Meta-relationship.........DataModelObject.ActsAs.RolePlayer  .
     Meta-attributes
     CDIFIdentifier...................SIM5_85A
     SourceEntity.....................SIM2_7
     DestinationEntity................SIM5_83A

Meta-relationship.........RolePlayer.Plays.Role
     Meta-attributes
     CDIFIdentifier...................SIM5_86A
     SourceEntity.....................SIM5_83A
     DestinationEntity................SIM5_82A
```

```
Meta-entity...............Role
     Meta-attributes
     CDIFIdentifier..................SIM5_82B
     Name............................"Child_uses_8"
     IsMaster........................False
     IsSource........................False

Meta-entity...............RolePlayer
     Meta-attributes
     CDIFIdentifier..................SIM5_83B
     Name.......  ....................."Class-Text_Child"
     MinInnerCardinality............."1"
     MaxInnerCardinality............."1"
     MinOuterCardinality............."1"
     MaxOuterCardinality............."1"

Meta-relationship.........Role.BelongsTo.Relationship
     Meta-attributes
     CDIFIdentifier..................SIM5_84B
     SourceEntity....................SIM5_82B
     DestinationEntity...............SIM5_8

Meta-relationship.........DataModelObject.ActsAs.RolePlayer
     Meta-attributes
     CDIFIdentifier..................SIM5_85B
     SourceEntity....................SIM2_8
     DestinationEntity...............SIM5_83B

Meta-relationship.........RolePlayer.Plays.Role
     Meta-attributes
     CDIFIdentifier..................SIM5_86B
     SourceEntity....................SIM5_83B
     DestinationEntity...............SIM5_82B
```

```
Meta-entity................Relationship
      Meta-attributes
      CDIFIdentifier...................SIM5_9
      Name.............................."is used as"
      BriefDescription................."This relates a Textbook to
                                       the Class-Text."

Meta-relationship.........DataModel.Collects.DataModelObject
      Meta-attributes
      CDIFIdentifier...................SIM5_91
      SourceEntity.....................SIM1_0
      DestinationEntity................SIM5_9

Meta-entity................Role
      Meta-attributes
      CDIFIdentifier...................SIM5_92A
      Name............................."Parent_is_used_as_9"
      IsMaster.........................True
      IsSource.........................True

Meta-entity................RolePlayer
      Meta-attributes
      CDIFIdentifier...................SIM5_93A
      Name............................."Textbook_Parent"
      MinInnerCardinality.............."0"
      MaxInnerCardinality.............."N"
      MinOuterCardinality.............."1"
      MaxOuterCardinality.............."1"

Meta-relationship.........Role.BelongsTo.Relationship
      Meta-attributes
      CDIFIdentifier...................SIM5_94A
      SourceEntity.....................SIM5_92A
      DestinationEntity................SIM5_9

Meta-relationship.........DataModelObject.ActsAs.RolePlayer
      Meta-attributes
      CDIFIdentifier...................SIM5_95A
      SourceEntity.....................SIM2_9
      DestinationEntity................SIM5_93A

Meta-relationship.........RolePlayer.Plays.Role
      Meta-attributes
      CDIFIdentifier...................SIM5_96A
      SourceEntity.....................SIM5_93A
      DestinationEntity................SIM5_92A
```

```
Meta-entity................Role
     Meta-attributes
     CDIFIdentifier...................SIM5_92B
     Name.............................."Child_is_used_as_9"
     IsMaster.........................False
     IsSource.........................False

Meta-entity...............RolePlayer
     Meta-attributes
     CDIFIdentifier...................SIM5_93B
     Name.............................."Class-Text_Child"
     MinInnerCardinality.............."1"
     MaxInnerCardinality.............."1"
     MinOuterCardinality.............."1"
     MaxOuterCardinality.............."1"

Meta-relationship.........Role.BelongsTo.Relationship
     Meta-attributes
     CDIFIdentifier...................SIM5_94B
     SourceEntity.....................SIM5_92B
     DestinationEntity................SIM5_9

Meta-relationship.........DataModelObject.ActsAs.RolePlayer
     Meta-attributes
     CDIFIdentifier...................SIM5_95B
     SourceEntity.....................SIM2_8
     DestinationEntity................SIM5_93B

Meta-relationship.........RolePlayer.Plays.Role
     Meta-attributes
     CDIFIdentifier...................SIM5_96B
     SourceEntity.....................SIM5_93B
     DestinationEntity................SIM5_92B
```

The following relationships are used to represent the full meaning of categorization.

Meta-entity.............Relationship
      Meta-attributes
      CDIFIdentifier...................SIM5_10
      Name...........................
      BriefDescription................"additional relationship
                               between Full-Time-Subtype
                                 and Full-Time"

Meta-relationship.........DataModel.Collects.DataModelObject
      Meta-attributes
      CDIFIdentifier...................SIM5_101
      SourceEntity....................SIM1_0
      DestinationEntity...............SIM5_10

Meta-entity.............Role
      Meta-attributes
      CDIFIdentifier...................SIM5_102A
      Name..........................."parent_full-time-subtype"
      IsMaster.......................True
      IsSource.......................True

Meta-entity.............RolePlayer
      Meta-attributes
      CDIFIdentifier...................SIM5_103A
      Name..........................."parent_full-time-subtype"
      MinInnerCardinality.............."1"
      MaxInnerCardinality.............."1"
      MinOuterCardinality.............."1"
      MaxOuterCardinality.............."1"

Meta-relationship.........Role.BelongsTo.Relationship
      Meta-attributes
      CDIFIdentifier...................SIM5_104A
      SourceEntity....................SIM5_102A
      DestinationEntity...............SIM5_10

Meta-relationship.........DataModelObject.ActsAs.RolePlayer
      Meta-attributes
      CDIFIdentifier...................SIM5_105A
      SourceEntity....................SIM2_10
      DestinationEntity...............SIM5_103A

Meta-relationship.........RolePlayer.Plays.Role
      Meta-attributes
      CDIFIdentifier...................SIM5_106A
      SourceEntity....................SIM5_103A
      DestinationEntity...............SIM5_102A

```
Meta-entity................Role
     Meta-attributes
     CDIFIdentifier..................SIM5_102B
     Name..........................."Child_full-time"
     IsMaster.......................False
     IsSource.......................False

Meta-entity...............RolePlayer
     Meta-attributes
     CDIFIdentifier..................SIM5_103B
     Name..........................."Child_full-time"
     MinInnerCardinality............"1"
     MaxInnerCardinality............"1"
     MinOuterCardinality............"1"
     MaxOuterCardinality............"1"

Meta-relationship.........Role.BelongsTo.Relationship
     Meta-attributes
     CDIFIdentifier..................SIM5_104B
     SourceEntity...................SIM5_102B
     DestinationEntity..............SIM5_10

Meta-relationship.........DataModelObject.ActsAs.RolePlayer
     Meta-attributes
     CDIFIdentifier..................SIM5_105B
     SourceEntity...................SIM2_12
     DestinationEntity..............SIM5_103B

Meta-relationship.........RolePlayer.Plays.Role
     Meta-attributes
     CDIFIdentifier..................SIM5_106B
     SourceEntity...................SIM5_103B
     DestinationEntity..............SIM5_102B
```

```
Meta-entity...............Relationship
     Meta-attributes
     CDIFIdentifier...................SIM5_11
     Name...............................
     BriefDescription.................."additional relationship
                                       between Part-Time-Subtype
                                       and Part-Time"

Meta-relationship.........DataModel.Collects.DataModelObject
     Meta-attributes
     CDIFIdentifier...................SIM5_111
     SourceEntity.....................SIM1_0
     DestinationEntity................SIM5_11

Meta-entity...............Role
     Meta-attributes
     CDIFIdentifier...................SIM5_112A
     Name............................."parent_part-time-subtype"
     IsMaster.........................True
     IsSource.........................True

Meta-entity...............RolePlayer
     Meta-attributes
     CDIFIdentifier...................SIM5_113A
     Name............................."parent_part-time-subtype"
     MinInnerCardinality.............."1"
     MaxInnerCardinality.............."1"
     MinOuterCardinality.............."1"
     MaxOuterCardinality.............."1"

Meta-relationship.........Role.BelongsTo.Relationship
     Meta-attributes
     CDIFIdentifier...................SIM5_114A
     SourceEntity.....................SIM5_112A
     DestinationEntity................SIM5_11

Meta-relationship.........DataModelObject.ActsAs.RolePlayer
     Meta-attributes
     CDIFIdentifier...................SIM5_115A
     SourceEntity.....................SIM2_11
     DestinationEntity................SIM5_113A

Meta-relationship.........RolePlayer.Plays.Role
     Meta-attributes
     CDIFIdentifier...................SIM5_116A
     SourceEntity.....................SIM5_113A
     DestinationEntity................SIM5_112A
```

```
Meta-entity...............Role
      Meta-attributes
      CDIFIdentifier...................SIM5_112B
      Name.............................."Child_part-time"
      IsMaster.........................False
      IsSource.........................False

Meta-entity...............RolePlayer
      Meta-attributes
      CDIFIdentifier...................SIM5_113B
      Name.............................."Child_part-time"
      MinInnerCardinality.............."1"
      MaxInnerCardinality.............."1"
      MinOuterCardinality.............."1"
      MaxOuterCardinality.............."1"

Meta-relationship.........Role.BelongsTo.Relationship
      Meta-attributes
      CDIFIdentifier...................SIM5_114B
      SourceEntity.....................SIM5_112B
      DestinationEntity................SIM5_11

Meta-relationship.........DataModelObject.ActsAs.RolePlayer
      Meta-attributes
      CDIFIdentifier...................SIM5_115B
      SourceEntity.....................SIM2_13
      DestinationEntity................SIM5_113B

Meta-relationship.........RolePlayer.Plays.Role
      Meta-attributes
      CDIFIdentifier...................SIM5_116B
      SourceEntity.....................SIM5_113B
      DestinationEntity................SIM5_112B
```

5.7 Attributes

First, the four attributes for the entity "Student" are defined.

Soc-Sec-No:
Meta-entity...............Attribute
    Meta-attributes
    CDIFIdentifier...................SIM6_0
    BriefDescription................"The unique identifier of a
                         Student."

Meta-entity...............Attribute
    Meta-attributes
    CDIFIdentifier...................SIM6_1
    Name............................."Student-Name"
    BriefDescription................"Identifier of a Student."

Meta-entity...............Attribute
    Meta-attributes
    CDIFIdentifier...................SIM6_2
    Name............................."Student-Address"
    BriefDescription................"The place where a Student
                         lives."

Meta-entity...............Attribute
    Meta-attributes
    CDIFIdentifier...................SIM6_4
    Name............................."Teaches_Instructor-Id"
    BriefDescription................"The unique identifier of the
                         Instructor that teaches a
                         Student (FK)."

Each is then related to the entity.

Meta-relationship.........AttributableObject.IsDescribedBy.Attribute
    Meta-attributes
    CDIFIdentifier...................SIM7_0
    SourceEntity.....................SIM2_0
    DestinationEntity...............SIM6_0
    SequenceNo......................1

Meta-relationship.........AttributableObject.IsDescribedBy.Attribute
    Meta-attributes
    CDIFIdentifier...................SIM7_1
    SourceEntity.....................SIM2_0
    DestinationEntity...............SIM6_1
    SequenceNo......................2

Meta-relationship.........AttributableObject.IsDescribedBy.Attribute
    Meta-attributes
    CDIFIdentifier...................SIM7_2
    SourceEntity.....................SIM2_0
    DestinationEntity...............SIM6_2
    SequenceNo......................3

```
Meta-relationship.........AttributableObject.IsDescribedBy.Attribute
     Meta-attributes
     CDIFIdentifier...................SIM7_4
     SourceEntity.....................SIM2_0
     DestinationEntity................SIM6_4
     SequenceNo.......................4
```

There is a need to link all foreign keys with primary keys by a meaning of the same definition.

```
Meta-entity...............AttributeDefinition
     Meta-attributes
     CDIFIdentifier...................SIM15_0
     Name............................."Soc-Sec-No"

Meta-relationship.........Attribute.IsBasedOn.AttributeDefinition
     Meta-attributes
     CDIFIdentifier...................SIM16_0
     SourceEntity.....................SIM6_0
     DestinationEntity................SIM15_0

Meta-entity...............AttributeDefinition
     Meta-attributes
     CDIFIdentifier...................SIM15_1
     Name............................."Instructor-ID"

Meta-relationship.........Attribute.IsBasedOn.AttributeDefinition
     Meta-attributes
     CDIFIdentifier...................SIM16_1
     SourceEntity.....................SIM6_4
     DestinationEntity................SIM15_1
```

The same is done for the attributes of "Enrollment".

Soc-Sec-No:
```
Meta-entity...............Attribute
     Meta-attributes
     CDIFIdentifier...................SIM6_5
     BriefDescription................."Social Security Number of
                                       the enrolled student."
```
Course-Code:
```
Meta-entity...............Attribute
     Meta-attributes
     CDIFIdentifier...................SIM6_6
     BriefDescription................."The code for a particular
                                       course."
```
Semester-No:
```
Meta-entity...............Attribute
     Meta-attributes
     CDIFIdentifier...................SIM6_7
     BriefDescription................."The number for a particular
                                       semester."
```
Section-No:
```
Meta-entity...............Attribute
     Meta-attributes
     CDIFIdentifier...................SIM6_8
     BriefDescription.................
```

```
Meta-entity...............Attribute
      Meta-attributes
      CDIFIdentifier...................SIM6_9
      Name.............................."Date-Enrolled"
      BriefDescription................."The date the enrollment took
                                        place."

Meta-entity...............Attribute
      Meta-attributes
      CDIFIdentifier...................SIM6_10
      Name.............................."Enrollment-Status"
      BriefDescription................."Part/Full time"

Meta-entity...............Attribute
      Meta-attributes
      CDIFIdentifier...................SIM6_11
      Name.............................."Enrollment-Type"
      BriefDescription.................

Meta-relationship.........AttributableObject.IsDescribedBy.Attribute
      Meta-attributes
      CDIFIdentifier...................SIM7_5
      SourceEntity.....................SIM2_1
      DestinationEntity................SIM6_5
      SequenceNo.......................1

Meta-relationship.........AttributableObject.IsDescribedBy.Attribute
      Meta-attributes
      CDIFIdentifier...................SIM7_6
      SourceEntity.....................SIM2_1
      DestinationEntity................SIM6_6
      SequenceNo.......................2

Meta-relationship.........AttributableObject.IsDescribedBy.Attribute
      Meta-attributes
      CDIFIdentifier...................SIM7_7
      SourceEntity.....................SIM2_1
      DestinationEntity................SIM6_7
      SequenceNo.......................3

Meta-relationship.........AttributableObject.IsDescribedBy.Attribute
      Meta-attributes
      CDIFIdentifier...................SIM7_8
      SourceEntity.....................SIM2_1
      DestinationEntity................SIM6_8
      SequenceNo.......................4

Meta-relationship.........AttributableObject.IsDescribedBy.Attribute
      Meta-attributes
      CDIFIdentifier...................SIM7_9
      SourceEntity.....................SIM2_1
      DestinationEntity................SIM6_9
      SequenceNo.......................5
```

Meta-relationship.........AttributableObject.IsDescribedBy.Attribute
    Meta-attributes
    CDIFIdentifier...................SIM7_10
    SourceEntity.....................SIM2_1
    DestinationEntity................SIM6_10
    SequenceNo.......................6

Meta-relationship.........AttributableObject.IsDescribedBy.Attribute
    Meta-attributes
    CDIFIdentifier...................SIM7_11
    SourceEntity.....................SIM2_1
    DestinationEntity................SIM6_11
    SequenceNo.......................7

Meta-entity..............AttributeDefinition
    Meta-attributes
    CDIFIdentifier...................SIM15_2
    Name............................."Course-Code"

Meta-relationship.........Attribute.IsBasedOn.AttributeDefinition
    Meta-attributes
    CDIFIdentifier...................SIM16_2
    SourceEntity.....................SIM6_6
    DestinationEntity................SIM15_2

Meta-entity..............AttributeDefinition
    Meta-attributes
    CDIFIdentifier...................SIM15_3
    Name............................."Semester-No"

Meta-relationship.........Attribute.IsBasedOn.AttributeDefinition
    Meta-attributes
    CDIFIdentifier...................SIM16_3
    SourceEntity.....................SIM6_7
    DestinationEntity................SIM15_3

Meta-entity..............AttributeDefinition
    Meta-attributes
    CDIFIdentifier...................SIM15_4
    Name............................."Section-No"

Meta-relationship.........Attribute.IsBasedOn.AttributeDefinition
    Meta-attributes
    CDIFIdentifier...................SIM16_4
    SourceEntity.....................SIM6_8
    DestinationEntity................SIM15_4

Soc-Sec-No:
Meta-relationship.........Attribute.IsBasedOn.AttributeDefinition
    Meta-attributes
    CDIFIdentifier...................SIM16_5
    SourceEntity.....................SIM6_5
    DestinationEntity................SIM15_0

Attributes of "Instructor".

```
Instructor-ID:
Meta-entity..............Attribute
      Meta-attributes
      CDIFIdentifier..................SIM6_12
      BriefDescription................"The unique identifier of the
                                       Instructor."
Instructor-Name:
Meta-entity..............Attribute
      Meta-attributes
      CDIFIdentifier..................SIM6_13
      BriefDescription................"The name of the Instructor."

Instructor-Addr:
Meta-entity..............Attribute
      Meta-attributes
      CDIFIdentifier..................SIM6_14
      BriefDescription................"The address of the
                                       Instructor."
Degree:
Meta-entity..............Attribute
      Meta-attributes
      CDIFIdentifier..................SIM6_15
      BriefDescription................"Instructor's degree."

Instructor-Type:
Meta-entity..............Attribute
      Meta-attributes
      CDIFIdentifier..................SIM6_16
      BriefDescription................"A discriminator: Full/Part
                                       time."

Meta-relationship........AttributableObject.IsDescribedBy.Attribute
      Meta-attributes
      CDIFIdentifier..................SIM7_12
      SourceEntity....................SIM2_5
      DestinationEntity...............SIM6_12
      SequenceNo......................1

Meta-relationship........AttributableObject.IsDescribedBy.Attribute
      Meta-attributes
      CDIFIdentifier..................SIM7_13
      SourceEntity....................SIM2_5
      DestinationEntity...............SIM6_13
      SequenceNo......................2

Meta-relationship........AttributableObject.IsDescribedBy.Attribute
      Meta-attributes
      CDIFIdentifier..................SIM7_14
      SourceEntity....................SIM2_5
      DestinationEntity...............SIM6_14
      SequenceNo......................3
```

Meta-relationship.........AttributableObject.IsDescribedBy.Attribute
    Meta-attributes
    CDIFIdentifier...................SIM7_15
    SourceEntity.....................SIM2_5
    DestinationEntity................SIM6_15
    SequenceNo.......................4

Meta-relationship.........AttributableObject.IsDescribedBy.Attribute
    Meta-attributes
    CDIFIdentifier...................SIM7_16
    SourceEntity.....................SIM2_5
    DestinationEntity................SIM6_16
    SequenceNo.......................5

Instructor-ID:
Meta-relationship.........Attribute.IsBasedOn.AttributeDefinition
    Meta-attributes
    CDIFIdentifier...................SIM16_6
    SourceEntity.....................SIM6_12
    DestinationEntity................SIM15_1

Meta-entity...............AttributeDefinition
    Meta-attributes
    CDIFIdentifier...................SIM15_5
    Name.............................."Instructor-Name"

Meta-relationship.........Attribute.IsBasedOn.AttributeDefinition
    Meta-attributes
    CDIFIdentifier...................SIM16_7
    SourceEntity.....................SIM6_13
    DestinationEntity................SIM15_5

Meta-entity...............AttributeDefinition
    Meta-attributes
    CDIFIdentifier...................SIM15_6
    Name.............................."Instructor-Addr"

Meta-relationship.........Attribute.IsBasedOn.AttributeDefinition
    Meta-attributes
    CDIFIdentifier...................SIM16_8
    SourceEntity.....................SIM6_14
    DestinationEntity................SIM15_6

Meta-entity...............AttributeDefinition
    Meta-attributes
    CDIFIdentifier...................SIM15_7
    Name.............................."Degree"

Meta-relationship.........Attribute.IsBasedOn.AttributeDefinition
    Meta-attributes
    CDIFIdentifier...................SIM16_9
    SourceEntity.....................SIM6_15
    DestinationEntity................SIM15_7

```
Meta-entity..............AttributeDefinition
     Meta-attributes
     CDIFIdentifier..................SIM15_8
     Name............................"Instructor-Type"

Meta-relationship........Attribute.IsBasedOn.AttributeDefinition
     Meta-attributes
     CDIFIdentifier..................SIM16_10
     SourceEntity....................SIM6_16
     DestinationEntity...............SIM15_8


These attributes are needed for transferring specialization.

Part-Time-Subtype:

Instructor-ID:
Meta-entity..............Attribute
     Meta-attributes
     CDIFIdentifier..................SIM6_17
     BriefDescription................"The unique identifier of
                                     Part-Time-Subtype."

Meta-relationship........Attribute.IsInheritedFrom.Attribute
     Meta-attributes
     CDIFIdentifier..................SIM6A_17
     SourceEntity....................SIM6_17
     DestinationEntity...............SIM6_12

Meta-entity..............Attribute
     Meta-attributes
     CDIFIdentifier..................SIM6_18
     BriefDescription................"The name of the instructor."

Meta-relationship........Attribute.IsInheritedFrom.Attribute
     Meta-attributes
     CDIFIdentifier..................SIM6A_18
     SourceEntity....................SIM6_18
     DestinationEntity...............SIM6_13

Meta-entity..............Attribute
     Meta-attributes
     CDIFIdentifier..................SIM6_19
     BriefDescription................"Address of instructor."

Meta-relationship........Attribute.IsInheritedFrom.Attribute
     Meta-attributes
     CDIFIdentifier..................SIM6A_19
     SourceEntity....................SIM6_19
     DestinationEntity...............SIM6_14

Meta-entity..............Attribute
     Meta-attributes
     CDIFIdentifier..................SIM6_191
     BriefDescription................"Degree of instructor."
```

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```
Meta-relationship........Attribute.IsInheritedFrom.Attribute
     Meta-attributes
     CDIFIdentifier...................SIM6A_191
     SourceEntity.....................SIM6_191
     DestinationEntity................SIM6_15

Meta-entity..............Attribute
     Meta-attributes
     CDIFIdentifier...................SIM6_192
     BriefDescription.................."Type of instructor
                                       (full/part)."

Meta-relationship........Attribute.IsInheritedFrom.Attribute
     Meta-attributes
     CDIFIdentifier...................SIM6A_192
     SourceEntity.....................SIM6_192
     DestinationEntity................SIM6_16

Meta-relationship........AttributableObject.IsDescribedBy.Attribute
     Meta-attributes
     CDIFIdentifier...................SIM7_17
     SourceEntity.....................SIM2_11
     DestinationEntity................SIM6_17
     SequenceNo.......................1

Meta-relationship........AttributableObject.IsDescribedBy.Attribute
     Meta-attributes
     CDIFIdentifier...................SIM7_18
     SourceEntity.....................SIM2_11
     DestinationEntity................SIM6_18
     SequenceNo.......................2

Meta-relationship........AttributableObject.IsDescribedBy.Attribute
     Meta-attributes
     CDIFIdentifier...................SIM7_19
     SourceEntity.....................SIM2_11
     DestinationEntity................SIM6_19
     SequenceNo.......................3

Meta-relationship........AttributableObject.IsDescribedBy.Attribute
     Meta-attributes
     CDIFIdentifier...................SIM7_191
     SourceEntity.....................SIM2_11
     DestinationEntity................SIM6_191
     SequenceNo.......................4

Meta-relationship........AttributableObject.IsDescribedBy.Attribute
     Meta-attributes
     CDIFIdentifier...................SIM7_192
     SourceEntity.....................SIM2_11
     DestinationEntity................SIM6_192
     SequenceNo.......................5
```

```
Instructor-ID:
Meta-relationship.........Attribute.IsBasedOn.AttributeDefinition
        Meta-attributes
        CDIFIdentifier.................SIM16_11
        SourceEntity....................SIM6_17
        DestinationEntity................SIM15_1

Instructor-Name:
Meta-relationship.........Attribute.IsBasedOn.AttributeDefinition
        Meta-attributes
        CDIFIdentifier.................SIM16_12
        SourceEntity....................SIM6_18
        DestinationEntity................SIM15_5

Instructor-Addr:
Meta-relationship.........Attribute.IsBasedOn.AttributeDefinition
        Meta-attributes
        CDIFIdentifier.................SIM16_13
        SourceEntity....................SIM6_19
        DestinationEntity................SIM15_6

Degree:
Meta-relationship.........Attribute.IsBasedOn.AttributeDefinition
        Meta-attributes
        CDIFIdentifier.................SIM16_14
        SourceEntity....................SIM6_191
        DestinationEntity................SIM15_7

Instructor-Type:
Meta-relationship.........Attribute.IsBasedOn.AttributeDefinition
        Meta-attributes
        CDIFIdentifier.................SIM16_15
        SourceEntity....................SIM6_192
        DestinationEntity................SIM15_8


Attributes of "Course".

Course-Code:
Meta-entity..............Attribute
        Meta-attributes
        CDIFIdentifier.................SIM6_20
        BriefDescription..............."The unique identifier of
                                        Course."

Meta-entity..............Attribute
        Meta-attributes
        CDIFIdentifier.................SIM6_21
        Name..........................."Course-Name"
        BriefDescription..............."The name of the course."

Meta-entity..............Attribute
        Meta-attributes
        CDIFIdentifier.................SIM6_22
        Name..........................."Std-Cred-Hrs"
        BriefDescription...............
```

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```
Meta-relationship.........AttributableObject.IsDescribedBy.Attribute
     Meta-attributes
     CDIFIdentifier...................SIM7_20
     SourceEntity.....................SIM2_3
     DestinationEntity................SIM6_20
     SequenceNo.......................1

Meta-relationship.........AttributableObject.IsDescribedBy.Attribute
     Meta-attributes
     CDIFIdentifier...................SIM7_21
     SourceEntity.....................SIM2_3
     DestinationEntity................SIM6_21
     SequenceNo.......................2

Meta-relationship.........AttributableObject.IsDescribedBy.Attribute
     Meta-attributes
     CDIFIdentifier...................SIM7_22
     SourceEntity.....................SIM2_3
     DestinationEntity................SIM6_22
     SequenceNo.......................3

Course-Code:
Meta-relationship.........Attribute.IsBasedOn.AttributeDefinition
     Meta-attributes
     CDIFIdentifier...................SIM16_16
     SourceEntity.....................SIM6_20
     DestinationEntity................SIM15_2

Attributes of "Offering".

Course-Code:
Meta-entity...............Attribute
     Meta-attributes
     CDIFIdentifier...................SIM6_23
     BriefDescription.................."Foreign key from Course."

Semester-No:
Meta-entity...............Attribute
     Meta-attributes
     CDIFIdentifier...................SIM6_24
     BriefDescription.................."Foreign key from Semester."

Meta-entity...............Attribute
     Meta-attributes
     CDIFIdentifier...................SIM6_25
     Name.............................."Act-Cred-Hrs"
     BriefDescription.................

Meta-relationship.........AttributableObject.IsDescribedBy.Attribute
     Meta-attributes
     CDIFIdentifier...................SIM7_23
     SourceEntity.....................SIM2_6
     DestinationEntity................SIM6_23
     SequenceNo.......................1
```

Meta-relationship........AttributableObject.IsDescribedBy.Attribute
     Meta-attributes
     CDIFIdentifier...................SIM7_24
     SourceEntity.....................SIM2_6
     DestinationEntity................SIM6_24
     SequenceNo.......................2

Meta-relationship........AttributableObject.IsDescribedBy.Attribute
     Meta-attributes
     CDIFIdentifier...................SIM7_25
     SourceEntity.....................SIM2_6
     DestinationEntity................SIM6_25
     SequenceNo.......................3

Course-Code:
Meta-relationship........Attribute.IsBasedOn.AttributeDefinition
     Meta-attributes
     CDIFIdentifier...................SIM16_17
     SourceEntity.....................SIM6_23
     DestinationEntity................SIM15_2

Semester-No:
Meta-relationship........Attribute.IsBasedOn.AttributeDefinition
     Meta-attributes
     CDIFIdentifier...................SIM16_18
     SourceEntity.....................SIM6_24
     DestinationEntity................SIM15_3

Attributes of "Semester".

Semester-No:
Meta-entity..............Attribute
     Meta-attributes
     CDIFIdentifier...................SIM6_26
     BriefDescription................."The unique identifier of
                             Semester."

Meta-entity..............Attribute
     Meta-attributes
     CDIFIdentifier...................SIM6_27
     Name............................."Start-Date"
     BriefDescription................."The date when the course
                             starts."

Meta-entity..............Attribute
     Meta-attributes
     CDIFIdentifier...................SIM6_28
     Name............................."End-Date"
     BriefDescription................."The date when the course
                             ends."

Meta-relationship.........AttributableObject.IsDescribedBy.Attribute
    Meta-attributes
    CDIFIdentifier....................SIM7_26
    SourceEntity......................SIM2_4
    DestinationEntity.................SIM6_26
    SequenceNo........................1

Meta-relationship.........AttributableObject.IsDescribedBy.Attribute
    Meta-attributes
    CDIFIdentifier....................SIM7_27
    SourceEntity......................SIM2_4
    DestinationEntity.................SIM6_27
    SequenceNo........................2

Meta-relationship.........AttributableObject.IsDescribedBy.Attribute
    Meta-attributes
    CDIFIdentifier....................SIM7_28
    SourceEntity......................SIM2_4
    DestinationEntity.................SIM6_28
    SequenceNo........................3

Semester-No:
Meta-relationship.........Attribute.IsBasedOn.AttributeDefinition
    Meta-attributes
    CDIFIdentifier....................SIM16_19
    SourceEntity......................SIM6_26
    DestinationEntity.................SIM15_3

These attributes are needed here to transfer the complete meaning of IDEF1X
categorization.

Full-Time-Subtype:

Instructor-ID:
Meta-entity..............Attribute
    Meta-attributes
    CDIFIdentifier....................SIM6_29
    BriefDescription.................."The unique identifier of
                                  Full-Time-Subtype."

Meta-relationship.........Attribute.IsInheritedFrom.Attribute
    Meta-attributes
    CDIFIdentifier....................SIM6A_29
    SourceEntity......................SIM6_29
    DestinationEntity.................SIM6_12

Meta-entity..............Attribute
    Meta-attributes
    CDIFIdentifier....................SIM6_30
    BriefDescription.................."The name of the instructor."

Meta-relationship.........Attribute.IsInheritedFrom.Attribute
    Meta-attributes
    CDIFIdentifier....................SIM6A_30
    SourceEntity......................SIM6_30
    DestinationEntity.................SIM6_13

```
Meta-entity..............Attribute
     Meta-attributes
     CDIFIdentifier...................SIM6_31
     BriefDescription................."Address of instructor."

Meta-relationship........Attribute.IsInheritedFrom.Attribute
     Meta-attributes
     CDIFIdentifier...................SIM6A_31
     SourceEntity.....................SIM6_31
     DestinationEntity................SIM6_14

Meta-entity..............Attribute
     Meta-attributes
     CDIFIdentifier...................SIM6_32
     BriefDescription................."Instructor's Degree."

Meta-relationship........Attribute.IsInheritedFrom.Attribute
     Meta-attributes
     CDIFIdentifier...................SIM6A_32
     SourceEntity.....................SIM6_32
     DestinationEntity................SIM6_15

Meta-entity..............Attribute
     Meta-attributes
     CDIFIdentifier...................SIM6_33
     BriefDescription................."Type of instructor
                                      (full/part)."

Meta-relationship........Attribute.IsInheritedFrom.Attribute
     Meta-attributes
     CDIFIdentifier...................SIM6A_33
     SourceEntity.....................SIM6_33
     DestinationEntity................SIM6_16

Meta-relationship........AttributableObject.IsDescribedBy.Attribute
     Meta-attributes
     CDIFIdentifier...................SIM7_29
     SourceEntity.....................SIM2_10
     DestinationEntity................SIM6_29
     SequenceNo.......................1

Meta-relationship........AttributableObject.IsDescribedBy.Attribute
     Meta-attributes
     CDIFIdentifier...................SIM7_30
     SourceEntity.....................SIM2_10
     DestinationEntity................SIM6_30
     SequenceNo.......................2

Meta-relationship........AttributableObject.IsDescribedBy.Attribute
     Meta-attributes
     CDIFIdentifier...................SIM7_31
     SourceEntity.....................SIM2_10
     DestinationEntity................SIM6_31
     SequenceNo.......................3
```

Meta-relationship.........AttributableObject.IsDescribedBy.Attribute
    Meta-attributes
    CDIFIdentifier...................SIM7_32
    SourceEntity.....................SIM2_10
    DestinationEntity................SIM6_32
    SequenceNo.......................4

Meta-relationship.........AttributableObject.IsDescribedBy.Attribute
    Meta-attributes
    CDIFIdentifier...................SIM7_33
    SourceEntity.....................SIM2_10
    DestinationEntity................SIM6_33
    SequenceNo.......................5

Instructor-ID:
Meta-relationship.........Attribute.IsBasedOn.AttributeDefinition
    Meta-attributes
    CDIFIdentifier...................SIM16_20
    SourceEntity.....................SIM6_29
    DestinationEntity................SIM15_1

Instructor-Name:
Meta-relationship.........Attribute.IsBasedOn.AttributeDefinition
    Meta-attributes
    CDIFIdentifier...................SIM16_21
    SourceEntity.....................SIM6_30
    DestinationEntity................SIM15_5

Instructor-Addr:
Meta-relationship.........Attribute.IsBasedOn.AttributeDefinition
    Meta-attributes
    CDIFIdentifier...................SIM16_22
    SourceEntity.....................SIM6_31
    DestinationEntity................SIM15_6

Degree:
Meta-relationship.........Attribute.IsBasedOn.AttributeDefinition
    Meta-attributes
    CDIFIdentifier...................SIM16_23
    SourceEntity.....................SIM6_32
    DestinationEntity................SIM15_7

Instructor-Type:
Meta-relationship.........Attribute.IsBasedOn.AttributeDefinition
    Meta-attributes
    CDIFIdentifier...................SIM16_24
    SourceEntity.....................SIM6_33
    DestinationEntity................SIM15_8

Attributes of "Full-Time".

Instructor-ID:
Meta-entity...............Attribute
    Meta-attributes
    CDIFIdentifier...................SIM6_34
    BriefDescription................

```
Meta-entity..............Attribute
      Meta-attributes
      CDIFIdentifier...................SIM6_35
      Name.............................."Annual-Salary"
      BriefDescription................."The Instructor's salary for
                                        the whole year."

Meta-relationship........AttributableObject.IsDescribedBy.Attribute
      Meta-attributes
      CDIFIdentifier...................SIM7_34
      SourceEntity.....................SIM2_12
      DestinationEntity................SIM6_34
      SequenceNo.......................1

Meta-relationship........AttributableObject.IsDescribedBy.Attribute
      Meta-attributes
      CDIFIdentifier...................SIM7_35
      SourceEntity.....................SIM2_12
      DestinationEntity................SIM6_35
      SequenceNo.......................2

Instructor-ID
Meta-relationship........Attribute.IsBasedOn.AttributeDefinition
      Meta-attributes
      CDIFIdentifier...................SIM16_25
      SourceEntity.....................SIM6_34
      DestinationEntity................SIM15_1


Attributes of "Part-Time".

Instructor-ID:
Meta-entity..............Attribute
      Meta-attributes
      CDIFIdentifier...................SIM6_36
      BriefDescription.................

Meta-entity..............Attribute
      Meta-attributes
      CDIFIdentifier...................SIM6_37
      Name.............................."Hourly-Rate"
      BriefDescription................."The Instructor's wages per
                                        hour."

Meta-relationship........AttributableObject.IsDescribedBy.Attribute
      Meta-attributes
      CDIFIdentifier...................SIM7_36
      SourceEntity.....................SIM2_13
      DestinationEntity................SIM6_36
      SequenceNo.......................1
```

Meta-relationship.........AttributableObject.IsDescribedBy.Attribute
    Meta-attributes
    CDIFIdentifier...................SIM7_37
    SourceEntity.....................SIM2_13
    DestinationEntity................SIM6_37
    SequenceNo.......................2

Instructor-ID:
Meta-relationship.........Attribute.IsBasedOn.AttributeDefinition
    Meta-attributes
    CDIFIdentifier...................SIM16_26
    SourceEntity.....................SIM6_36
    DestinationEntity................SIM15_1

Attributes of "Class-Section".

Course-Code:
Meta-entity..............Attribute
    Meta-attributes
    CDIFIdentifier...................SIM6_38
    BriefDescription................."A foreign key from
                        Offering."

Semester-No:
Meta-entity..............Attribute
    Meta-attributes
    CDIFIdentifier...................SIM6_39
    BriefDescription................."A foreign key from
                        Semester."

Section-No:
Meta-entity..............Attribute
    Meta-attributes
    CDIFIdentifier...................SIM6_40
    BriefDescription................."The unique identifier of
                        Class-Section."

Instructor-ID:
Meta-entity..............Attribute
    Meta-attributes
    CDIFIdentifier...................SIM6_41
    BriefDescription................."A foreign key from
                        Instructor."

Meta-relationship.........AttributableObject.IsDescribedBy.Attribute
    Meta-attributes
    CDIFIdentifier...................SIM7_38
    SourceEntity.....................SIM2_7
    DestinationEntity................SIM6_38
    SequenceNo.......................1

Meta-relationship.........AttributableObject.IsDescribedBy.Attribute
      Meta-attributes
      CDIFIdentifier...................SIM7_39
      SourceEntity.....................SIM2_7
      DestinationEntity................SIM6_39
      SequenceNo.......................2

Meta-relationship.........AttributableObject.IsDescribedBy.Attribute
      Meta-attributes
      CDIFIdentifier...................SIM7_40
      SourceEntity.....................SIM2_7
      DestinationEntity................SIM6_40
      SequenceNo.......................3

Meta-relationship.........AttributableObject.IsDescribedBy.Attribute
      Meta-attributes
      CDIFIdentifier...................SIM7_41
      SourceEntity.....................SIM2_7
      DestinationEntity................SIM6_41
      SequenceNo.......................4

Course-Code:
Meta-relationship.........Attribute.IsBasedOn.AttributeDefinition
      Meta-attributes
      CDIFIdentifier...................SIM16_27
      SourceEntity.....................SIM6_38
      DestinationEntity................SIM15_2

Semester-No:
Meta-relationship.........Attribute.IsBasedOn.AttributeDefinition
      Meta-attributes
      CDIFIdentifier...................SIM16_28
      SourceEntity.....................SIM6_39
      DestinationEntity................SIM15_3

Section-No:
Meta-relationship.........Attribute.IsBasedOn.AttributeDefinition
      Meta-attributes
      CDIFIdentifier...................SIM16_29
      SourceEntity.....................SIM6_40
      DestinationEntity................SIM15_4

Instructor-ID:
Meta-relationship.........Attribute.IsBasedOn.AttributeDefinition
      Meta-attributes
      CDIFIdentifier...................SIM16_30
      SourceEntity.....................SIM6_41
      DestinationEntity................SIM15_1

```
Attributes of "Textbook".
Textbook-No:
Meta-entity...............Attribute
      Meta-attributes
      CDIFIdentifier..................SIM6_42
      BriefDescription................"The unique identifier of
                                       Textbook."

Meta-entity...............Attribute
      Meta-attributes
      CDIFIdentifier..................SIM6_43
      Name............................"Textbook-Name"
      BriefDescription................"The name of the textbook."

Meta-entity...............Attribute
      Meta-attributes
      CDIFIdentifier..................SIM6_44
      Name............................"Pub-Co-Name"
      BriefDescription................"The name of the publishing
                                       company."

Meta-relationship.........AttributableObject.IsDescribedBy.Attribute
      Meta-attributes
      CDIFIdentifier..................SIM7_42
      SourceEntity....................SIM2_9
      DestinationEntity...............SIM6_42
      SequenceNo......................1

Meta-relationship.........AttributableObject.IsDescribedBy.Attribute
      Meta-attributes
      CDIFIdentifier..................SIM7_43
      SourceEntity....................SIM2_9
      DestinationEntity...............SIM6_43
      SequenceNo......................2

Meta-relationship.........AttributableObject.IsDescribedBy.Attribute
      Meta-attributes
      CDIFIdentifier..................SIM7_44
      SourceEntity....................SIM2_9
      DestinationEntity...............SIM6_44
      SequenceNo......................3

Meta-entity...............AttributeDefinition
      Meta-attributes
      CDIFIdentifier..................SIM15_9
      Name............................"Textbook_No"

Meta-relationship.........Attribute.IsBasedOn.AttributeDefinition
      Meta-attributes
      CDIFIdentifier..................SIM16_31
      SourceEntity....................SIM6_42
      DestinationEntity...............SIM15_9


Attributes of "Attendance".
```

Soc-Sec-No:
Meta-entity..............Attribute
     Meta-attributes
     CDIFIdentifier...................SIM6_45
     BriefDescription................."A foreign key from
                               Enrollment."

Course-Code:
Meta-entity..............Attribute
     Meta-attributes
     CDIFIdentifier...................SIM6_46
     BriefDescription................."A foreign key from
                               Enrollment."

Semester-No:
Meta-entity..............Attribute
     Meta-attributes
     CDIFIdentifier...................SIM6_47
     BriefDescription................."A foreign key from
                               Enrollment."

Section-No:
Meta-entity..............Attribute
     Meta-attributes
     CDIFIdentifier...................SIM6_48
     BriefDescription................."A foreign key from
                               Enrollment."

Meta-entity..............Attribute
     Meta-attributes
     CDIFIdentifier...................SIM6_49
     Name............................."Attendance-Status"
     BriefDescription.................

Meta-relationship........AttributableObject.IsDescribedBy.Attribute
     Meta-attributes
     CDIFIdentifier...................SIM7_45
     SourceEntity.....................SIM2_2
     DestinationEntity................SIM6_45
     SequenceNo.......................1

Meta-relationship........AttributableObject.IsDescribedBy.Attribute
     Meta-attributes
     CDIFIdentifier...................SIM7_46
     SourceEntity.....................SIM2_2
     DestinationEntity................SIM6_46
     SequenceNo.......................2

Meta-relationship........AttributableObject.IsDescribedBy.Attribute
     Meta-attributes
     CDIFIdentifier...................SIM7_47
     SourceEntity.....................SIM2_2
     DestinationEntity................SIM6_47
     SequenceNo.......................3

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Meta-relationship........AttributableObject.IsDescribedBy.Attribute
    Meta-attributes
    CDIFIdentifier...................SIM7_48
    SourceEntity.....................SIM2_2
    DestinationEntity................SIM6_48
    SequenceNo.......................4

Meta-relationship........AttributableObject.IsDescribedBy.Attribute
    Meta-attributes
    CDIFIdentifier...................SIM7_49
    SourceEntity.....................SIM2_2
    DestinationEntity................SIM6_49
    SequenceNo.......................5

Soc-Sec-No:
Meta-relationship........Attribute.IsBasedOn.AttributeDefinition
    Meta-attributes
    CDIFIdentifier...................SIM16_32
    SourceEntity.....................SIM6_45
    DestinationEntity................SIM15_0

Course-Code:
Meta-relationship........Attribute.IsBasedOn.AttributeDefinition
    Meta-attributes
    CDIFIdentifier...................SIM16_33
    SourceEntity.....................SIM6_46
    DestinationEntity................SIM15_2

Semester-No:
Meta-relationship........Attribute.IsBasedOn.AttributeDefinition
    Meta-attributes
    CDIFIdentifier...................SIM16_34
    SourceEntity.....................SIM6_47
    DestinationEntity................SIM15_3

Section-No:
Meta-relationship........Attribute.IsBasedOn.AttributeDefinition
    Meta-attributes
    CDIFIdentifier...................SIM16_35
    SourceEntity.....................SIM6_48
    DestinationEntity................SIM15_4

Attributes of "Class-Text".
Textbook-No:
Meta-entity...............Attribute
    Meta-attributes
    CDIFIdentifier...................SIM6_50
    BriefDescription................."A foreign key from
                                Textbook."

Course-Code:
Meta-entity...............Attribute
    Meta-attributes
    CDIFIdentifier...................SIM6_51
    BriefDescription................."A foreign key from
                                Class-Section."

Semester-No:
Meta-entity..............Attribute
     Meta-attributes
     CDIFIdentifier...................SIM6_52
     BriefDescription................."A foreign key from
                               Class-Section."

Section-No:
Meta-entity..............Attribute
     Meta-attributes
     CDIFIdentifier...................SIM6_53
     BriefDescription................."A foreign key from
                               Class-Section."

Meta-relationship........AttributableObject.IsDescribedBy.Attribute
     Meta-attributes
     CDIFIdentifier...................SIM7_50
     SourceEntity.....................SIM2_8
     DestinationEntity................SIM6_50
     SequenceNo.......................1

Meta-relationship........AttributableObject.IsDescribedBy.Attribute
     Meta-attributes
     CDIFIdentifier...................SIM7_51
     SourceEntity.....................SIM2_8
     DestinationEntity................SIM6_51
     SequenceNo.......................2

Meta-relationship........AttributableObject.IsDescribedBy.Attribute
     Meta-attributes
     CDIFIdentifier...................SIM7_52
     SourceEntity.....................SIM2_8
     DestinationEntity................SIM6_52
     SequenceNo.......................3

Meta-relationship........AttributableObject.IsDescribedBy.Attribute
     Meta-attributes
     CDIFIdentifier...................SIM7_53
     SourceEntity.....................SIM2_8
     DestinationEntity................SIM6_53
     SequenceNo.......................4

Textbook-No:
Meta-relationship........Attribute.IsBasedOn.AttributeDefinition
     Meta-attributes
     CDIFIdentifier...................SIM16_36
     SourceEntity.....................SIM6_50
     DestinationEntity................SIM15_9

Course-Code:
Meta-relationship........Attribute.IsBasedOn.AttributeDefinition
     Meta-attributes
     CDIFIdentifier...................SIM16_37
     SourceEntity.....................SIM6_51
     DestinationEntity................SIM15_2

```
Semester-No:
Meta-relationship........Attribute.IsBasedOn.AttributeDefinition
     Meta-attributes
     CDIFIdentifier...................SIM16_38
     SourceEntity.....................SIM6_52
     DestinationEntity................SIM15_3

Section-No:
Meta-relationship........Attribute.IsBasedOn.AttributeDefinition
     Meta-attributes
     CDIFIdentifier...................SIM16_39
     SourceEntity.....................SIM6_53
     DestinationEntity................SIM15_4
```

For each entity we have to create a candidate key and relate it to it's entity.

```
Meta-entity..............CandidateKey
     Meta-attributes
     CDIFIdentifier...................SIM8_0
     Name............................."Student-Key"
     IsPrimary........................True

Meta-relationship........Entity.Contains.Key
     Meta-attributes
     CDIFIdentifier...................SIM9_0
     SourceEntity.....................SIM2_0
     DestinationEntity................SIM8_0
```

Since we have already defined CDIF Meta-entities Attribute and CandidateKey, now we are ready to relate them to each other.

```
Meta-relationship........Attribute.IsComponentOf.Key
     Meta-attributes
     CDIFIdentifier...................SIM10_0
     SourceEntity.....................SIM6_0
     DestinationEntity................SIM8_0
     SequenceNo.......................1


Meta-entity..............CandidateKey
     Meta-attributes
     CDIFIdentifier...................SIM8_1
     Name............................."Enrollment-Key"
     IsPrimary........................True

Meta-relationship........Entity.Contains.Key
     Meta-attributes
     CDIFIdentifier...................SIM9_1
     SourceEntity.....................SIM2_1
     DestinationEntity................SIM8_1
```

```
Meta-relationship........Attribute.IsComponentOf.Key
     Meta-attributes
     CDIFIdentifier...................SIM10_1A
     SourceEntity.....................SIM6_5
     DestinationEntity................SIM8_1
     SequenceNo.......................1

Meta-relationship........Attribute.IsComponentOf.Key
     Meta-attributes
     CDIFIdentifier...................SIM10_1B
     SourceEntity.....................SIM6_6
     DestinationEntity................SIM8_1
     SequenceNo.......................2

Meta-relationship........Attribute.IsComponentOf.Key
     Meta-attributes
     CDIFIdentifier...................SIM10_1C
     SourceEntity.....................SIM6_7
     DestinationEntity................SIM8_1
     SequenceNo.......................3

Meta-relationship........Attribute.IsComponentOf.Key
     Meta-attributes
     CDIFIdentifier...................SIM10_1D
     SourceEntity.....................SIM6_8
     DestinationEntity................SIM8_1
     SequenceNo.......................4


Meta-entity..............CandidateKey
     Meta-attributes
     CDIFIdentifier...................SIM8_2
     Name............................."Full-Time-Subtype-Key"
     IsPrimary........................True

Meta-relationship........Entity.Contains.Key
     Meta-attributes
     CDIFIdentifier...................SIM9_2
     SourceEntity.....................SIM2_10
     DestinationEntity................SIM8_2

Meta-relationship........Attribute.IsComponentOf.Key
     Meta-attributes
     CDIFIdentifier...................SIM10_2A
     SourceEntity.....................SIM6_29
     DestinationEntity................SIM8_2
     SequenceNo.......................1


Meta-entity..............CandidateKey
     Meta-attributes
     CDIFIdentifier...................SIM8_3
     Name............................."Part-Time-Subtype-Key"
     IsPrimary........................True
```

```
Meta-relationship........Entity.Contains.Key
     Meta-attributes
     CDIFIdentifier...................SIM9_3
     SourceEntity.....................SIM2_11
     DestinationEntity................SIM8_3

Meta-relationship........Attribute.IsComponentOf.Key
     Meta-attributes
     CDIFIdentifier...................SIM10_3A
     SourceEntity.....................SIM6_17
     DestinationEntity................SIM8_3
     SequenceNo.......................1


Meta-entity...............CandidateKey
     Meta-attributes
     CDIFIdentifier...................SIM8_4
     Name.............................."Attendance-Key"
     IsPrimary........................True

Meta-relationship........Entity.Contains.Key
     Meta-attributes
     CDIFIdentifier...................SIM9_4
     SourceEntity.....................SIM2_2
     DestinationEntity................SIM8_4

Meta-relationship........Attribute.IsComponentOf.Key
     Meta-attributes
     CDIFIdentifier...................SIM10_4A
     SourceEntity.....................SIM6_45
     DestinationEntity................SIM8_4
     SequenceNo.......................1

Meta-relationship........Attribute.IsComponentOf.Key
     Meta-attributes
     CDIFIdentifier...................SIM10_4B
     SourceEntity.....................SIM6_46
     DestinationEntity................SIM8_4
     SequenceNo.......................2

Meta-relationship........Attribute.IsComponentOf.Key
     Meta-attributes
     CDIFIdentifier...................SIM10_4C
     SourceEntity.....................SIM6_47
     DestinationEntity................SIM8_4
     SequenceNo.......................3

Meta-relationship........Attribute.IsComponentOf.Key
     Meta-attributes
     CDIFIdentifier...................SIM10_4D
     SourceEntity.....................SIM6_48
     DestinationEntity................SIM8_4
     SequenceNo.......................4
```

```
Meta-entity...............CandidateKey
     Meta-attributes
     CDIFIdentifier..................SIM8_5
     Name............................."Course-Key"
     IsPrimary.......................True

Meta-relationship.........Entity.Contains.Key
     Meta-attributes
     CDIFIdentifier..................SIM9_5
     SourceEntity....................SIM2_3
     DestinationEntity...............SIM8_5

Meta-relationship.........Attribute.IsComponentOf.Key
     Meta-attributes
     CDIFIdentifier..................SIM10_5A
     SourceEntity....................SIM6_20
     DestinationEntity...............SIM8_5
     SequenceNo......................1


Meta-entity...............CandidateKey
     Meta-attributes
     CDIFIdentifier..................SIM8_6
     Name............................."Semester-Key"
     IsPrimary.......................True

Meta-relationship.........Entity.Contains.Key
     Meta-attributes
     CDIFIdentifier..................SIM9_6
     SourceEntity....................SIM2_4
     DestinationEntity...............SIM8_6

Meta-relationship.........Attribute.IsComponentOf.Key
     Meta-attributes
     CDIFIdentifier..................SIM10_6A
     SourceEntity....................SIM6_26
     DestinationEntity...............SIM8_6
     SequenceNo......................1


Meta-entity...............CandidateKey
     Meta-attributes
     CDIFIdentifier..................SIM8_7
     Name............................."Instructor-Key"
     IsPrimary.......................True

Meta-relationship.........Entity.Contains.Key
     Meta-attributes
     CDIFIdentifier..................SIM9_7
     SourceEntity....................SIM2_5
     DestinationEntity...............SIM8_7
```

```
Meta-relationship.........Attribute.IsComponentOf.Key
     Meta-attributes
     CDIFIdentifier...................SIM10_7A
     SourceEntity.....................SIM6_12
     DestinationEntity................SIM8_7
     SequenceNo.......................1


Meta-entity..............CandidateKey
     Meta-attributes
     CDIFIdentifier...................SIM8_8
     Name............................."Offering-Key"
     IsPrimary........................True

Meta-relationship.........Entity.Contains.Key
     Meta-attributes
     CDIFIdentifier...................SIM9_8
     SourceEntity.....................SIM2_6
     DestinationEntity................SIM8_8

Meta-relationship.........Attribute.IsComponentOf.Key
     Meta-attributes
     CDIFIdentifier...................SIM10_8A
     SourceEntity.....................SIM6_23
     DestinationEntity................SIM8_8
     SequenceNo.......................1

Meta-relationship.........Attribute.IsComponentOf.Key
     Meta-attributes
     CDIFIdentifier...................SIM10_8B
     SourceEntity.....................SIM6_24
     DestinationEntity................SIM8_8
     SequenceNo.......................2


Meta-entity..............CandidateKey
     Meta-attributes
     CDIFIdentifier...................SIM8_9
     Name............................."Class-Section-Key"
     IsPrimary........................True

Meta-relationship.........Entity.Contains.Key
     Meta-attributes
     CDIFIdentifier...................SIM9_9
     SourceEntity.....................SIM2_7
     DestinationEntity................SIM8_9

Meta-relationship.........Attribute.IsComponentOf.Key
     Meta-attributes
     CDIFIdentifier...................SIM10_9A
     SourceEntity.....................SIM6_38
     DestinationEntity................SIM8_9
     SequenceNo.......................1
```

```
Meta-relationship.........Attribute.IsComponentOf.Key
     Meta-attributes
     CDIFIdentifier...................SIM10_9B
     SourceEntity.....................SIM6_39
     DestinationEntity................SIM8_9
     SequenceNo.......................2

Meta-relationship.........Attribute.IsComponentOf.Key
     Meta-attributes
     CDIFIdentifier...................SIM10_9C
     SourceEntity.....................SIM6_40
     DestinationEntity................SIM8_9
     SequenceNo.......................3


Meta-entity...............CandidateKey
     Meta-attributes
     CDIFIdentifier...................SIM8_10
     Name............................."Class-Text-Key"
     IsPrimary........................True

Meta-relationship.........Entity.Contains.Key
     Meta-attributes
     CDIFIdentifier...................SIM9_10
     SourceEntity.....................SIM2_8
     DestinationEntity................SIM8_10

Meta-relationship.........Attribute.IsComponentOf.Key
     Meta-attributes
     CDIFIdentifier...................SIM10_10A
     SourceEntity.....................SIM6_50
     DestinationEntity................SIM8_10
     SequenceNo.......................1

Meta-relationship.........Attribute.IsComponentOf.Key
     Meta-attributes
     CDIFIdentifier...................SIM10_10B
     SourceEntity.....................SIM6_51
     DestinationEntity................SIM8_10
     SequenceNo.......................2

Meta-relationship.........Attribute.IsComponentOf.Key
     Meta-attributes
     CDIFIdentifier...................SIM10_10C
     SourceEntity.....................SIM6_52
     DestinationEntity................SIM8_10
     SequenceNo.......................3

Meta-relationship.........Attribute.IsComponentOf.Key
     Meta-attributes
     CDIFIdentifier...................SIM10_10D
     SourceEntity.....................SIM6_53
     DestinationEntity................SIM8_10
     SequenceNo.......................4
```

.

```
Meta-entity...............CandidateKey
      Meta-attributes
      CDIFIdentifier...................SIM8_11
      Name............................."Textbook-Key"
      IsPrimary........................True

Meta-relationship.........Entity.Contains.Key
      Meta-attributes
      CDIFIdentifier...................SIM9_11
      SourceEntity.....................SIM2_9
      DestinationEntity................SIM8_11

Meta-relationship.........Attribute.IsComponentOf.Key
      Meta-attributes
      CDIFIdentifier...................SIM10_11A
      SourceEntity.....................SIM6_42
      DestinationEntity................SIM8_11
      SequenceNo.......................1


Meta-entity...............CandidateKey
      Meta-attributes
      CDIFIdentifier...................SIM8_12
      Name............................."Full-Time-Key"
      IsPrimary........................True

Meta-relationship.........Entity.Contains.Key
      Meta-attributes
      CDIFIdentifier...................SIM9_12
      SourceEntity.....................SIM2_12
      DestinationEntity................SIM8_12

Meta-relationship.........Attribute.IsComponentOf.Key
      Meta-attributes
      CDIFIdentifier...................SIM10_12A
      SourceEntity.....................SIM6_34
      DestinationEntity................SIM8_12
      SequenceNo.......................1


Meta-entity...............CandidateKey
      Meta-attributes
      CDIFIdentifier...................SIM8_13
      Name............................."Part-Time-Key"
      IsPrimary........................True

Meta-relationship.........Entity.Contains.Key
      Meta-attributes
      CDIFIdentifier...................SIM9_13
      SourceEntity.....................SIM2_13
      DestinationEntity................SIM8_13
```

```
Meta-relationship.........Attribute.IsComponentOf.Key
      Meta-attributes
      CDIFIdentifier...................SIM10_13A
      SourceEntity.....................SIM6_36
      DestinationEntity................SIM8_13
      SequenceNo.......................1
```

For some entities we have to create a ForeignKey, relate this key to it's Entity and Attribute, and reference it to the CandidateKey.

```
Meta-entity...............ForeignKey
      Meta-attributes
      CDIFIdentifier...................SIM11_0
      Name............................."Student-Enrollment-FK"

Meta-relationship.........Entity.Contains.Key
      Meta-attributes
      CDIFIdentifier...................SIM12_0
      SourceEntity.....................SIM2_1
      DestinationEntity................SIM11_0

Meta-relationship.........ForeignKey.References.CandidateKey
      Meta-attributes
      CDIFIdentifier...................SIM13_0
      SourceEntity.....................SIM11_0
      DestinationEntity................SIM8_0

Meta-relationship.........Attribute.IsComponentOf.Key
      Meta-attributes
      CDIFIdentifier...................SIM14_0A
      SourceEntity.....................SIM6_5
      DestinationEntity................SIM11_0
      SequenceNo.......................1


Meta-entity...............ForeignKey
      Meta-attributes
      CDIFIdentifier...................SIM11_1
      Name............................."Course-Offering-FK"

Meta-relationship.........Entity.Contains.Key
      Meta-attributes
      CDIFIdentifier...................SIM12_1
      SourceEntity.....................SIM2_6
      DestinationEntity................SIM11_1

Meta-relationship.........ForeignKey.References.CandidateKey
      Meta-attributes
      CDIFIdentifier...................SIM13_1
      SourceEntity.....................SIM11_1
      DestinationEntity................SIM8_5
```

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```
Meta-relationship.........Attribute.IsComponentOf.Key
     Meta-attributes
     CDIFIdentifier...................SIM14_1A
     SourceEntity.....................SIM6_23
     DestinationEntity................SIM11_1
     SequenceNo.......................1


Meta-entity................ForeignKey
     Meta-attributes
     CDIFIdentifier...................SIM11_2
     Name............................."Semester-Offering-FK"

Meta-relationship.........Entity.Contains.Key
     Meta-attributes
     CDIFIdentifier...................SIM12_2
     SourceEntity.....................SIM2_6
     DestinationEntity................SIM11_2

Meta-relationship.........ForeignKey.References.CandidateKey
     Meta-attributes
     CDIFIdentifier...................SIM13_2
     SourceEntity.....................SIM11_2
     DestinationEntity................SIM8_6

Meta-relationship.........Attribute.IsComponentOf.Key
     Meta-attributes
     CDIFIdentifier...................SIM14_2A
     SourceEntity.....................SIM6_24
     DestinationEntity................SIM11_2
     SequenceNo.......................1


Meta-entity................ForeignKey
     Meta-attributes
     CDIFIdentifier...................SIM11_3
     Name............................."Instructor-Student-FK"

Meta-relationship.........Entity.Contains.Key
     Meta-attributes
     CDIFIdentifier...................SIM12_3
     SourceEntity.....................SIM2_0
     DestinationEntity................SIM11_3

Meta-relationship.........ForeignKey.References.CandidateKey
     Meta-attributes
     CDIFIdentifier...................SIM13_3
     SourceEntity.....................SIM11_3
     DestinationEntity................SIM8_7
```

```
Meta-relationship.........Attribute.IsComponentOf.Key
      Meta-attributes
      CDIFIdentifier..................SIM14_3A
      SourceEntity....................SIM6_4
      DestinationEntity...............SIM11_3
      SequenceNo......................1


Meta-entity..............ForeignKey
      Meta-attributes
      CDIFIdentifier..................SIM11_4
      Name............................"Instructor-Class-Section-FK"

Meta-relationship.........Entity.Contains.Key
      Meta-attributes
      CDIFIdentifier..................SIM12_4
      SourceEntity....................SIM2_7
      DestinationEntity...............SIM11_4

Meta-relationship.........ForeignKey.References.CandidateKey
      Meta-attributes
      CDIFIdentifier..................SIM13_4
      SourceEntity....................SIM11_4
      DestinationEntity...............SIM8_7

Meta-relationship.........Attribute.IsComponentOf.Key
      Meta-attributes
      CDIFIdentifier..................SIM14_4A
      SourceEntity....................SIM6_41
      DestinationEntity...............SIM11_4
      SequenceNo......................1


Meta-entity..............ForeignKey
      Meta-attributes
      CDIFIdentifier..................SIM11_5
      Name............................"Class-Section-Enrollment-FK"

Meta-relationship.........Entity.Contains.Key
      Meta-attributes
      CDIFIdentifier..................SIM12_5
      SourceEntity....................SIM2_1
      DestinationEntity...............SIM11_5

Meta-relationship.........ForeignKey.References.CandidateKey
      Meta-attributes
      CDIFIdentifier..................SIM13_5
      SourceEntity....................SIM11_5
      DestinationEntity...............SIM8_9
```

```
Meta-relationship.........Attribute.IsComponentOf.Key
    Meta-attributes
    CDIFIdentifier...................SIM14_5A
    SourceEntity.....................SIM6_6
    DestinationEntity................SIM11_5
    SequenceNo.......................1

Meta-relationship.........Attribute.IsComponentOf.Key
    Meta-attributes
    CDIFIdentifier...................SIM14_5B
    SourceEntity.....................SIM6_7
    DestinationEntity................SIM11_5
    SequenceNo.......................2

Meta-relationship.........Attribute.IsComponentOf.Key
    Meta-attributes
    CDIFIdentifier...................SIM14_5C
    SourceEntity.....................SIM6_8
    DestinationEntity................SIM11_5
    SequenceNo.......................3


Meta-entity...............ForeignKey
    Meta-attributes
    CDIFIdentifier...................SIM11_6
    Name............................."Enrollment-Attendance-FK"

Meta-relationship.........Entity.Contains.Key
    Meta-attributes
    CDIFIdentifier...................SIM12_6
    SourceEntity.....................SIM2_2
    DestinationEntity................SIM11_6

Meta-relationship.........ForeignKey.References.CandidateKey
    Meta-attributes
    CDIFIdentifier...................SIM13_6
    SourceEntity.....................SIM11_6
    DestinationEntity................SIM8_1

Meta-relationship.........Attribute.IsComponentOf.Key
    Meta-attributes
    CDIFIdentifier...................SIM14_6A
    SourceEntity.....................SIM6_45
    DestinationEntity................SIM11_6
    SequenceNo.......................1

Meta-relationship.........Attribute.IsComponentOf.Key
    Meta-attributes
    CDIFIdentifier...................SIM14_6B
    SourceEntity.....................SIM6_46
    DestinationEntity................SIM11_6
    SequenceNo.......................2
```

```
Meta-relationship.........Attribute.IsComponentOf.Key
     Meta-attributes
     CDIFIdentifier.................SIM14_6C
     SourceEntity...................SIM6_47
     DestinationEntity..............SIM11_6
     SequenceNo.....................3

Meta-relationship.........Attribute.IsComponentOf.Key
     Meta-attributes
     CDIFIdentifier.................SIM14_6D
     SourceEntity...................SIM6_48
     DestinationEntity..............SIM11_6
     SequenceNo.....................4


Meta-entity...............ForeignKey
     Meta-attributes
     CDIFIdentifier.................SIM11_7
     Name..........................."Class-Section-Class-Text-FK"

Meta-relationship.........Entity.Contains.Key
     Meta-attributes
     CDIFIdentifier.................SIM12_7
     SourceEntity...................SIM2_8
     DestinationEntity..............SIM11_7

Meta-relationship.........ForeignKey.References.CandidateKey
     Meta-attributes
     CDIFIdentifier.................SIM13_7
     SourceEntity...................SIM11_7
     DestinationEntity..............SIM8_9

Meta-relationship.........Attribute.IsComponentOf.Key
     Meta-attributes
     CDIFIdentifier.................SIM14_7A
     SourceEntity...................SIM6_51
     DestinationEntity..............SIM11_7
     SequenceNo.....................1

Meta-relationship.........Attribute.IsComponentOf.Key
     Meta-attributes
     CDIFIdentifier.................SIM14_7B
     SourceEntity...................SIM6_52
     DestinationEntity..............SIM11_7
     SequenceNo.....................2

Meta-relationship.........Attribute.IsComponentOf.Key
     Meta-attributes
     CDIFIdentifier.................SIM14_7C
     SourceEntity...................SIM6_53
     DestinationEntity..............SIM11_7
     SequenceNo.....................3
```

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```
Meta-entity...............ForeignKey
     Meta-attributes
     CDIFIdentifier...................SIM11_8
     Name.............................."Textbook-Class-Text-FK"

Meta-relationship.........Entity.Contains.Key
     Meta-attributes
     CDIFIdentifier...................SIM12_8
     SourceEntity.....................SIM2_8
     DestinationEntity................SIM11_8

Meta-relationship.........ForeignKey.References.CandidateKey
     Meta-attributes
     CDIFIdentifier...................SIM13_8
     SourceEntity.....................SIM11_8
     DestinationEntity................SIM8_11

Meta-relationship.........Attribute.IsComponentOf.Key
     Meta-attributes
     CDIFIdentifier...................SIM14_8A
     SourceEntity.....................SIM6_50
     DestinationEntity................SIM11_8
     SequenceNo.......................1


Meta-entity...............ForeignKey
     Meta-attributes
     CDIFIdentifier...................SIM11_9
     Name.............................."Offering-Class-Section-FK"

Meta-relationship.........Entity.Contains.Key
     Meta-attributes
     CDIFIdentifier...................SIM12_9
     SourceEntity.....................SIM2_7
     DestinationEntity................SIM11_9

Meta-relationship.........ForeignKey.References.CandidateKey
     Meta-attributes
     CDIFIdentifier...................SIM13_9
     SourceEntity.....................SIM11_9
     DestinationEntity................SIM8_8

Meta-relationship.........Attribute.IsComponentOf.Key
     Meta-attributes
     CDIFIdentifier...................SIM14_9A
     SourceEntity.....................SIM6_38
     DestinationEntity................SIM11_9
     SequenceNo.......................1

Meta-relationship.........Attribute.IsComponentOf.Key
     Meta-attributes
     CDIFIdentifier...................SIM14_9A
     SourceEntity.....................SIM6_39
     DestinationEntity................SIM11_9
     SequenceNo.......................2
```

```
Meta-entity...............ForeignKey
     Meta-attributes
     CDIFIdentifier..................SIM11_10
     Name............................"Full-Time-Sbtp-Full-Time-FK"

Meta-relationship.........Entity.Contains.Key
     Meta-attributes
     CDIFIdentifier..................SIM12_10
     SourceEntity....................SIM2_12
     DestinationEntity...............SIM11_10

Meta-relationship.........ForeignKey.References.CandidateKey
     Meta-attributes
     CDIFIdentifier..................SIM13_10
     SourceEntity....................SIM11_10
     DestinationEntity...............SIM8_2

Meta-relationship.........Attribute.IsComponentOf.Key
     Meta-attributes
     CDIFIdentifier..................SIM14_10A
     SourceEntity....................SIM6_34
     DestinationEntity...............SIM11_10
     SequenceNo......................1


Meta-entity...............ForeignKey
     Meta-attributes
     CDIFIdentifier..................SIM11_11
     Name............................"Part-Time-Sbtp-Part-Time-FK"

Meta-relationship.........Entity.Contains.Key
     Meta-attributes
     CDIFIdentifier..................SIM12_11
     SourceEntity....................SIM2_13
     DestinationEntity...............SIM11_11

Meta-relationship.........ForeignKey.References.CandidateKey
     Meta-attributes
     CDIFIdentifier..................SIM13_11
     SourceEntity....................SIM11_11
     DestinationEntity...............SIM8_3

Meta-relationship.........Attribute.IsComponentOf.Key
     Meta-attributes
     CDIFIdentifier..................SIM14_11
     SourceEntity....................SIM6_36
     DestinationEntity...............SIM11_11
     SequenceNo......................1
```

APPENDIX A: IDEF1X CATEGORIZATION MAPPING

<u>Problem</u>

Almost all things in the world can be classified into different categories according to some common characteristics or functions. We classify humans into males and females; we classify cars into new and used; we classify food into bread and butter. This concept in IDEF1X is called Categorization relationship. "Human" is called generic entity, while "Male" and "Female" are category entities.

If we classify food into bread and butter only, we will have an incomplete categorization because there are lots of other types of food (crabs, cheese, tomatoes, potato chips, etc.). We can say that a categorization is complete if we categorize a generic entity into a finite number of category entities, and each instance of the generic entity is also an instance of one and only one category entity.

Let's look at an IDEF1X categorization of "Instructor." Because full-time instructors and part-time instructors have some common characteristics such as names, addresses, and degrees, we can associate those characteristics with both types of instructors at the same time. We can do this by letting those common attributes be attrributes of the generic entity "Instructor." In this case we say that those attributes are inherited from the generic entity "Instructor" by the category entities "Full-Time" and "Part-Time." In the relational database those attributes are stored in the "Instructor" table, and are repeated neither in the "Part-Time" table nor in the "Full-Time" table. Only a primary key - a unique set of one or more attributes that identifies each instance of an entity - is repeated in each of those three tables to identify the entities and preserve the integrity between them. In this case an attribute Instructor-ID (assuming that IDs are unique) can be the primary key of "Instructor," "Full-Time," and "Part-Time."

Figure 6

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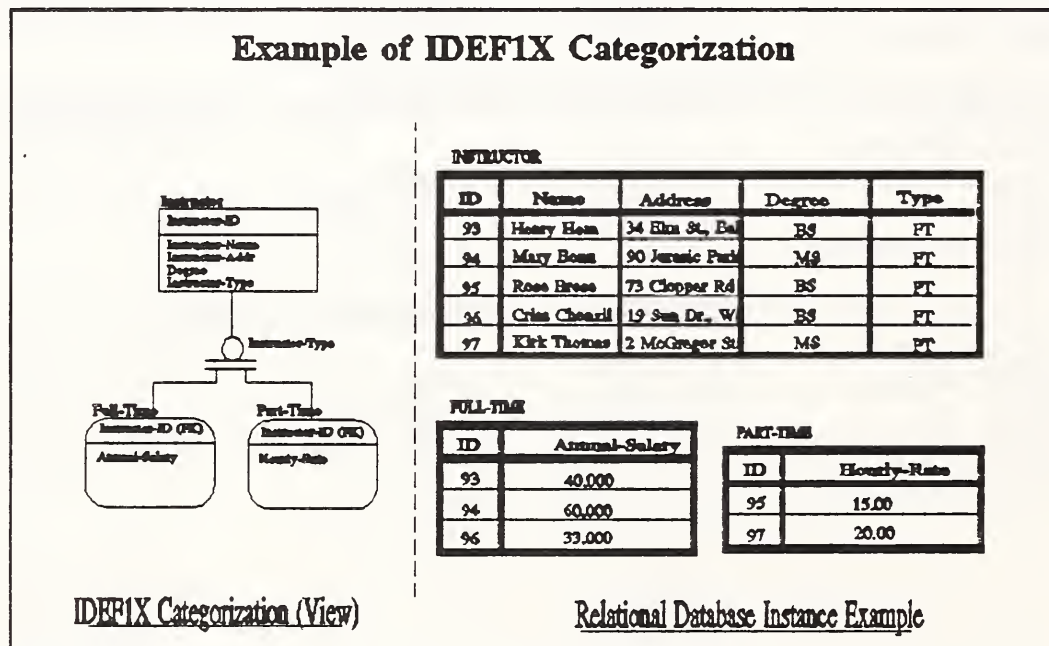
CDIF preserves the meaning of categorization in its super/subtyping. It supports four important characteristics such as coverage, exclusivity, orthogonality, and inheritance. Coverage is used very well in mapping the meaning of completeness. Exclusivity just means that for one instance of a generic entity there should be no more than one instance of a category entity. Orthogonality supports multiple categorizations for a single generic entity, i.e. an instructor can be classified into one set of categories (male/female) according to its gender, or into another set of categories (part-time/full-time) according to its job status. Inheritance associates subtypes with the properties (attributes and relationships) of their supertypes. At each level of the subtyping hierarchy, there should be a local copy of each inherited *Attribute*. That is where the problem in mapping it to IDEF1X categorization occurs.

IDEF1X does not have a local copy of each inherited attribute at each level of the categorization. Instead, only one copy of those attributes is owned by only one entity - the generic entity. Also, in IDEF1X each instance of a category entity has foreign keys migrated from the corresponding instance of its generic entity, while in CDIF this is not true. In CDIF, at the instance level, there does not have to be an instance of a generic entity for an instance of a corresponding category entity. So, if there are only two types of instructors - full-time and part-time, and there are no other types, then, from the implementation point of view, we do not need to have the "Instructor" table in the relational database because ALL the instances are going to be in either the "Full-Time-Instructor" table or the "Part-Time-Instructor" table.

Figure 7

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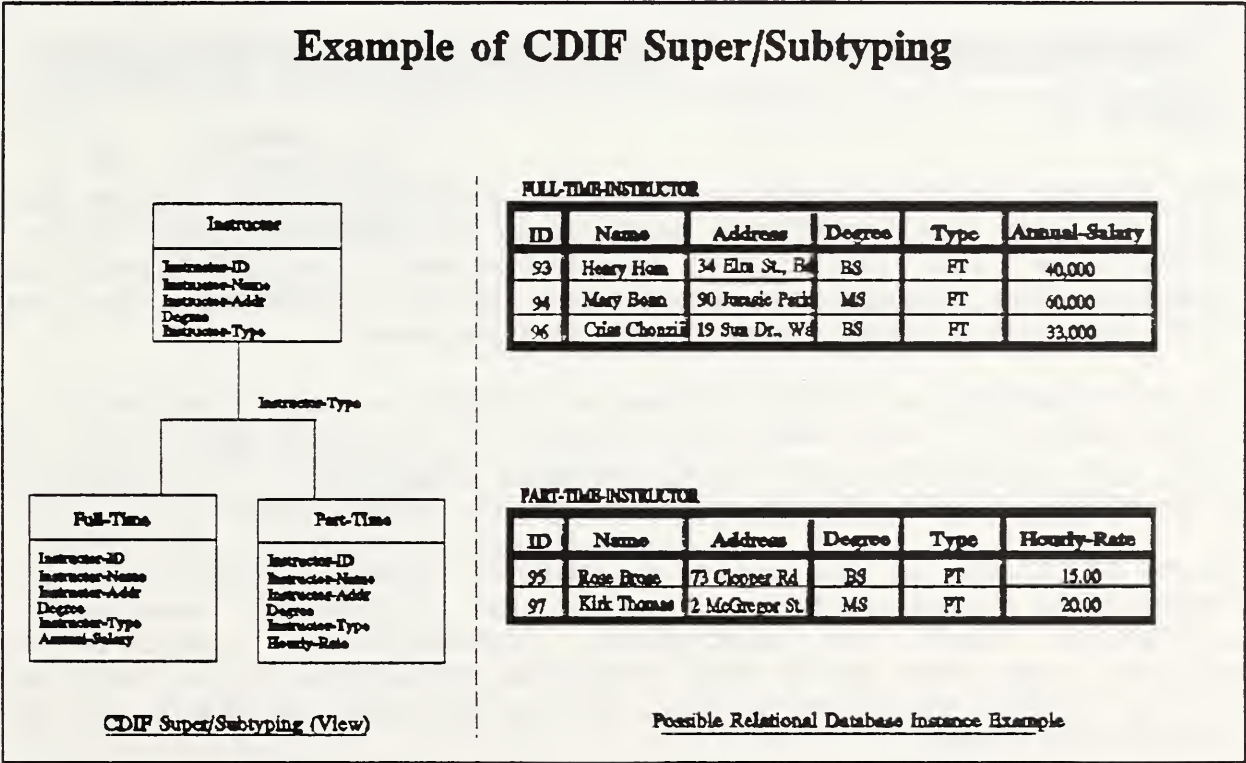
Solutions

One solution is to treat an IDEF1X categorization, while mapping to CDIF, as a set of one-to-zero-or-one mutually exclusive relationships from the generic entity to the category entities. In this case we will have the same tables (extension and intention) for CDIF and IDEF1X in the relational database.

Alternative solution to IDEF1X Categorization mapping

INSTRUCTOR

ID	Name	Address	Degree	Type
93	Henry Horn	34 Elm St., Bal	BS	FT
94	Mary Bonn	90 Jurasic Park	MS	FT
95	Rose Brose	73 Clopper Rd	BS	PT
96	Criss Chonzil	19 Sun Dr., W	BS	FT
97	Kirk Thomas	2 McGregor St	MS	PT

FULL-TIME

ID	Annual-Salary
93	40,000
94	60,000
96	33,000

PART-TIME

ID	Hourly-Rate
95	15.00
97	20.00

Categorization - alternative picture   Relational Database Instance Example (IDEF1X & CDIF)

Figure 8

But even though in this case we have the same database scheme for IDEF1X and CDIF, we lose the important meaning of categorization. How do we show that "Full-Time" and "Part-Time" are different types of "Instructor?" We are missing the important construct which contains the means of supertype/subtype, inheritance, and completeness.

The second solution is simply to map an IDEF1X categorization to the CDIF super/subtyping. In this case we probably will preserve all the important means of the concept, but will have a different structure for the instance level, which may be acceptable in some cases.

The third solution is to treat an IDEF1X categorization as a type of super/subtyping construct with all the important meanings of the categorization such as subtyping, inheritance, completeness, and exclusivity[1], and then force the instance structure to be very much like one for the IDEF1X categorization. We can do this by combining our first and second solutions.

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[1]The concept of exclusivity is still open to discussion but looks like it can be easily solved.

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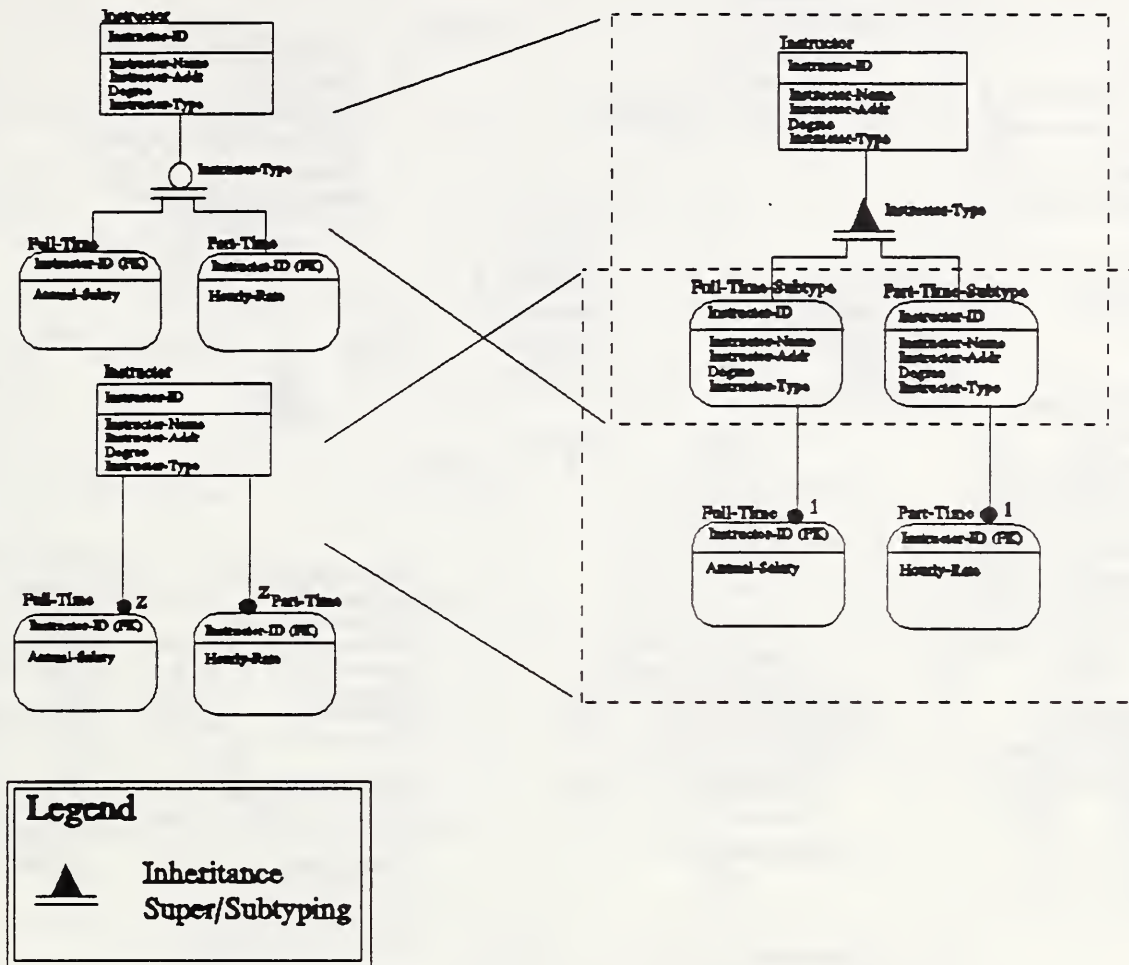
Figure 9

The construct[1] transfers semantics of IDEF1X categorization, while the set of (2 in this case) exclusive relationships transfers the meaning of instantiation of IDEF1X categorization.

---

[1]This construct was introduced in its graphical form just to simplify the explanation of the mapping. It represents CDIF subtyping, which includes inheritance, coverage (completeness), orthogonality (two or more categorizations for a generic entity are allowed), and exclusivity.

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APPENDIX B: HELPFUL DIAGRAMS

These diagrams are provided here to help the reader who is trying to "walk through" the mapping example. They contain *CDIFIdentifiers* for most of the CDIF meta-entities and some meta-relationships.
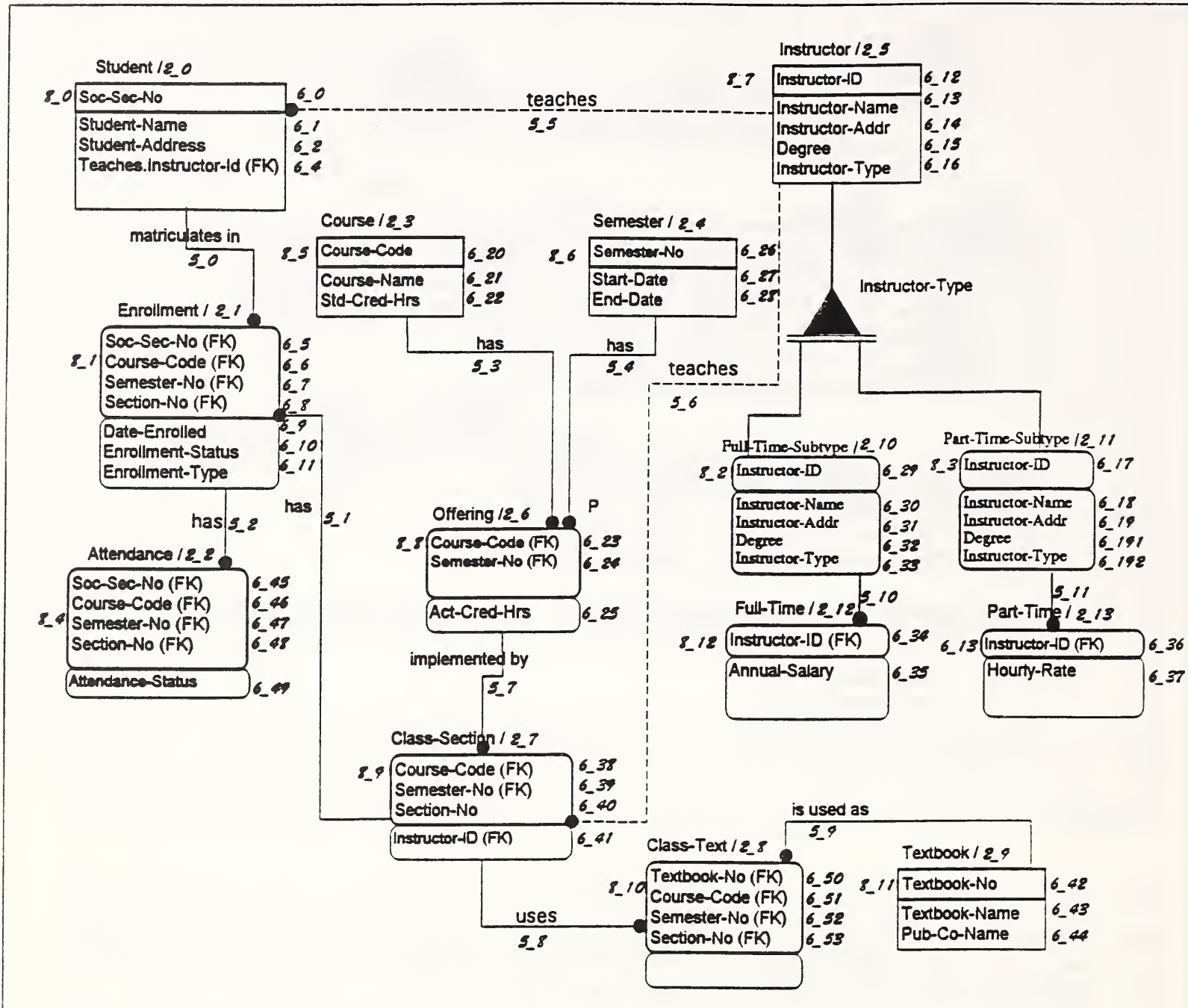
Figure 11

Legend for CDIF IDs:

5_*   Relationship

6_*   Attribute

8_*   CandidateKey

2_*   Entity

Legend for invented symbols:
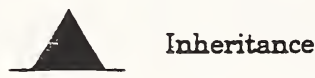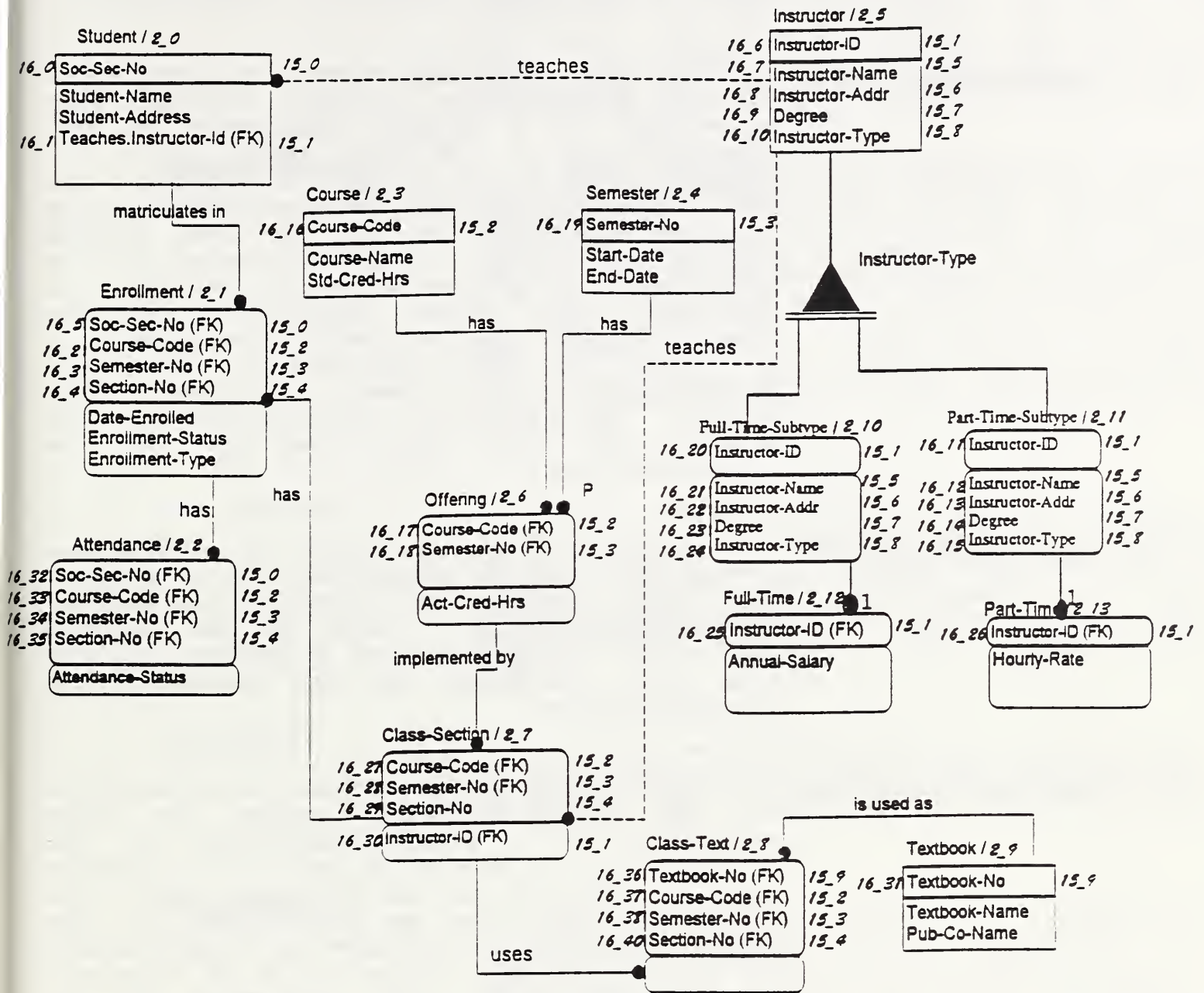
Inheritance

Figure 12

Legend for CDIF IDs:

*15_* • AttributeDefinition

*16_* • Attribute.IsBasedOn.AttributeDefinition

/ • Entity

Legend for invented symbols:

Inheritance

GLOSSARY

CDIFIdentifier An attribute that uniquely identifies an object in the Model Section of a transfer.

MinInnerCardinality Defines the minimum number of occurrences of the *Relationship* related through this *RolePlayer* to a single occurrence of the *DataModelObject*. If the value is 0, it indicates that the *RolePlayer* is Optional, and that therefore there can be occurrences of the *DataModelObject* that do not take part (acting as this *RolePlayer*) in any occurrences of this *Relationship*. If the value is non-zero, it indicates that each occurrence of the *DataModelObject* shall act as this *RolePlayer* in at least as many occurrences of this *Relationship* as the number specified. This defines the minimum cardinality of the *Relationship* from the viewpoint of the *DataModelObject*.

MaxInnerCardinality Defines the maximum number of occurrences of the *Relationship* acting as this *RolePlayer* that can be connected to a single occurrence of the *DataModelObject*. This is the maximum cardinality of the owning *Relationship* seen from the viewpoint of the participating *DataModelObject*.

MinOuterCardinality Defines the minimum number of occurrences of the *DataModelObject* acting as this *RolePlayer* to a single occurrence of the *Relationship*. If the value is 0, it indicates that the *RolePlayer* is Optional, and that therefore there can be occurrences of the *Relationship* that do not have any object acting as this *RolePlayer*. If the value in non-zero, it indicates that each occurrence of the *Relationship* shall have at least the number specified of related object occurrences in this *RolePlayer*.

MaxOuterCardinality Defines the maximum number of occurrences of the *DataModelObject* acting as this *RolePlayer* that can be connected to a single occurrence of the *Relationship*.

Kernel This classification is used for an entity

whose instances are meaningful without the occurrences of other entities. For example, an instance of an entity, having a name and a description, is significant without the knowledge of the data model to which it belongs. The fact that an entity can be kernel does not imply that it can be uniquely identified without other scoping information.

Characteristic
Each instance of a characteristic entity is logically related to a single instance of another entity. Therefore, the attributes could be considered to belong to the related entity, where the owning entity is related to the characteristic entity with a relationship of cardinality 1:1. Characteristic entities are usually used to group together related attributes which are optional, and enable the kernel entity to have a smaller fixed set of attributes.

Associative
This classification is used for entities whose existence is dependent upon the existence of two or more other entities; they are used to resolve many-to-many relationships et al. *Entity* instances cannot exist without the existence of instances of the related entity types.

IsPrimary
A local meta-attribute of a *CandidateKey*. If *TRUE*, this defines a particular *CandidateKey* as having been selected as the primary key for an *Entity*.

SequenceNo
A local meta-attribute of a *DataObject* .*IsDescribedBy*.*SemanticInformationObject*.
This defines the place of the object within the set which occur within the parent *DataObject*. Constraints: No two components within the same *DataObject* should have the same value for *SequenceNo*.

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REFERENCES

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3. EIA, <u>CDIF - Framework for Modeling and Extensibility</u>, EIA/IS-107, January 1994.

4. EIA, <u>CDIF - CASE Data Interchange Format - Overview</u>, EIA/IS-106, January 1994.

5. EIA, <u>CDIF - Integrated Meta-model - Data Modeling Subject Area</u>[1], EIA/PN-3072, CDIF-DRAFT-DMOD-V11, Editor: Rob Hill, July 1994.

6. EIA, <u>CDIF - Integrated Meta-model - Data Definition Subject Area</u>[1], EIA/PN-3071, CDIF-DRAFT-DDEF-V8, Editor: Mike Imber, March 1994.

7. Bruce, T. A., <u>Designing Quality Databases with IDEF1X Information Models</u>. Dorset House Publishing, New York, 1992.

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[1]The referenced version of the EIA document is the latest one available for public review. However, the mapping in this NIST document is based on updated information from the July 1994 CDIF meeting.